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THE DESIGN, APPLICATION AND FUTURE DEVELOPMENT OF THE *FINANCIAL TIMES*-ACTUARIES INDEX

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THE original Actuaries Index was designed in 1929 and was maintained with broadly the same format and principles for more than thirty years, changes to constituents and groups being made in 1950 and 1957. 'Investment Policy and Index Numbers, submitted by the authors in 1956 (*J.I.A.* **83,** 333), discussed the original index in some detail. This index was, of course, designed for manual calculation and it is remarkable that only eight years ago electronic computation was not even contemplated. In fact the word computer was never mentioned in the paper or in the discussion. With electronic facilities now so well developed the whole approach to indices is changed. The limitations, formerly imposed by manual calculation, on the size, the scope of the averaging procedures and the weighting methods, and the frequency of computation are no longer important.

2. In these circumstances the index procedure required complete recasting. The first question was the frequency of computation. There is little doubt that, for many of the purposes of an index, daily, rather than monthly computation is needed. This facility, however, represented a major problem as the task of collecting prices for a large index on a daily basis was clearly beyond the resources of the Actuarial Tuition Service staff who had computed the index for many years. Furthermore, the former procedure with distribution of the results by post would have delayed publication. In these circumstances collaboration with a newspaper organization offered many advantages, solving both the staff problem and the publication difficulties simultaneously. It was fortunate that at the same time as the Investment Research Committee was considering this problem the statistical staff of the *Financial Times* were also contemplating an extension of their daily index facilities. The logical development was for the Actuarial organizations and the leading financial newspaper to enter into a joint index project, the design and averaging methods, etc., being the responsibility of the actuaries with the newspaper staff doing all the pricing, collecting the statistics and using the computer facilities of the National Cash Register Company. The selection of constituents and groups was a joint undertaking of the actuaries and the *Financial Times* statistical staff.

3. Once this project had been agreed the way was open to design an index which would continue to satisfy the principal uses already established for both its 'parents'. These uses are:

(a) *Investment policy*

The original purpose of the Actuaries Index, as envisaged by C. M. Douglas, was to serve as a guide to investment policy, to assist in the timing of equity purchases and in the selection of industrial groups, etc.

(b) *Portfolio performance*

The *Financial Times* 30 share index, being available every day, had become the accepted standard for checking the progress of equity portfolios.

(c) *Historical studies*

Again the *Financial Times* 30 share index, with its long unbroken series, has been the recognized standard for studying the relative yield of equities as against gilt-edged and for watching the long-term progress of equities generally.

(d) *Economic surveys*

If the national economy becomes subject to a greater degree of planning, the need will arise for reliable information regarding the progress of profits and dividends compared with wages, productivity and living costs. A comprehensive index correctly reproducing the results of a substantial proportion of U.K. industry will be an important factor in national economic planning.

(e) *Other day-to-day investment problems*

Both the original indices had been used for a variety of investment problems. Examples of these are:

(i) Pricing unquoted securities.
(ii) Making approximate valuations.
(iii) Comparing the prices of deals in the same share at different times.

4. Bearing in mind these varied requirements, the Joint Investment Research Committee of the Institute and Faculty was charged with the task of designing suitable indices for equities, preference shares, debentures and gilt-edged stocks. Details of the procedures involved in selecting the constituents, in calculating the averages and in maintaining the series up to date are discussed in Parts I and II below.

5. Part III, entitled 'The Index in Practice', deals with the improved facilities the new indices offer towards the solution of some of the varied problems of investment management and economic research.

6. Some suggestions are made in Part IV for further development of the index facilities. Finally, in Part V entitled 'Investment Analysis by Computer' attention is drawn to the need for further research work to make more use of the valuable statistics already recorded in the computer.

7. It must be understood that in making their comments on the various indices the authors are expressing their personal views which may not necessarily reflect the opinions of the other members of the Investment Research Committees.

PART I. DESIGNING THE EQUITY INDEX

Choice of constituents

8. As the index is intended to reflect the performance of the whole U.K. ordinary share market, a survey was first made of all the companies with shares quoted on the London Stock Exchange and having equity market capitalizations of over £1 million. There is little to be gained by including the mass of small companies with a lower capitalization than this. In the case of many of them dealings in their shares are infrequent so that prices are largely 'nominal' and quotations are wide.

9. Some 650 companies, each with market capitalization greater than £4 million, had a combined capitalization equal to some 90% of the total for all the possible companies with market valuation greater than £1 million. It was decided, therefore, to base the selection of securities for the index on this group of 650 companies. Companies whose trading activities were completely outside this country, and companies controlled by other U.K. concerns or whose assets consisted largely of shares in companies already included in the index, were omitted. Industrial holding companies, such as Thomas Tilling, B.E.T., etc., were excluded because it is impossible to allocate such companies to specific industrial groups.

Industrial groups

10. Consideration was first given to the groupings used in existing indices and in the classification of the *Financial Times* Profits Tables. The following broad groups were then chosen: capital goods, consumer durables, consumer non-durables, chemicals, oil, shipping, financial and miscellaneous.

11. The first three groups and the financial group were next subdivided into fairly homogeneous sub-groups, each considered to be affected by similar broad economic developments. Companies with diverse activities were placed in one of four miscellaneous groups, according to whether their output ranked as capital goods, consumer durables, consumer goods or unclassifiable. Some of the resulting groups were felt to be too small and these were increased by bringing in those companies with a market valuation in the £2 million to £4 million range.

12. Originally the financial groups covered 128 securities of which 54 were those of investment trusts. It was considered that this latter figure was much too large, giving undue emphasis to this particular financial sub-group. Consequently for these the lower valuation limit was raised to £16 million which reduced the number to 20 and the total financial companies to 94. The net result of the exclusions and the addition of the few companies with a market capitalization below £4 million was to leave 594

securities to form the All-Share Index. Their total equity market capitalization amounted to 60% approximately of the value of all quoted equities in the sections concerned. Omitting the 94 financial companies left the 500 industrial constituents which form the basis of the alternative 500 share index.

Dividends and earnings

13. It has been decided that average dividend yields and average earning yields should be provided. Unfortunately, in the case of the financial groups it is not possible to obtain reliable earnings figures from the published accounts because of the accounting privileges given to banks, discount houses and insurance companies. Even in those cases where some earnings figures are available they are hardly comparable with the earnings yields on industrial shares. Consequently the 500 share index with its sub-indices should be regarded as the standard daily index recording earnings yields. However, for portfolios including important holdings of shares in financial companies the 594 share index will probably be the better standard for checking the price and dividend performance.

Methods of averaging

14. In the previous paper it was stated that the method of construction should depend on the purpose of the index and since there are several purposes a compromise was always necessary. The disadvantages and advantages of the geometric and arithmetic means were outlined. Several speakers in the discussion recognized that the authors were themselves not convinced about the advantages of the geometric mean. If one was thinking in terms of a *price* index only, then much could be said for the geometric mean, but as most users of indices were not content with a simple price index and usually wanted a standard for comparative purposes, the arithmetic average would appear to be the more appropriate. During the discussion J. D. Binns remarked 'If we were starting afresh I would urge the method of weighted arithmetic mean'. Almost all well-known indices used in Europe and in the United States of America are arithmetic and for many of them the weights are proportionate to market capitalization. The Indices of Standard and Poor (U.S.A.), Commission de la Bourse (Belgium) and the Swiss Bank Corporation are calculated in the same way as the *Financial Times*–Actuaries Index.

15. The new index is basically a weighted arithmetic mean of the price relatives. Formally it can be written

$$\frac{\Sigma w \dfrac{p_t}{p_o}}{\Sigma w}$$

and the main question for consideration is that of the choice of weights. Weighting is necessary because of the varying importance of the securities

from an investment point of view. If the purpose of the index is to reflect movements of the market as a whole then an appropriate weighting would be the market capitalization of the securities in the index.

16. If a purely price index is considered then theoretically the weights should be fixed because changes in the index should reflect changes in prices only. However, the purpose of the index is to measure movements of the market as a whole so that it would be misleading to regard it as a price index only. It is, perhaps, better to regard the constituents as a portfolio representing the market, and the index as a measure of the changing value of the portfolio. Fixed weights imply a fixed portfolio and the main objection to such a portfolio is that in the long run it would cease to represent the market as a whole. The only way to represent the changing market is to construct a set of rules designed to ensure that the constituents are in some reasonable sense kept up to date. However, in the first place it is helpful to consider the construction of a fixed-weight index.

17. A common form of fixed weight formula is:

$$\frac{\Sigma n_o p_o \frac{p_t}{p_o}}{\Sigma n_o p_o} = \frac{\Sigma n_o p_t}{\Sigma n_o p_o}$$

where p_t is the price at time t, and n_o is the number of shares at the base date. It is well known that one cannot leave the position as simple as this. Some adjustment must be made for bonus issues, rights issues and share splits, otherwise the ratios p_t/p_o will become meaningless and invalidate the index. It is necessary therefore to decide what capital and other changes must be allowed for and construct a set of rules for dealing with them.

18. The rules can generally be interpreted as a redistribution of the 'portfolio' by a notional purchase and sale, assuming no costs. This notional transaction may be confined to the particular constituent affected, or may be spread over the group concerned, or the whole index. To demonstrate these procedures in general terms, suppose that the first change is made at time s and let n'_s and p'_s be the number of shares and the price just after the change. The p'_s for those securities affected by the change may be theoretical prices calculated from the terms of the change and for the remaining securities $p'_s = p_s$. The old portfolio is notionally sold for $\Sigma n_o\, p_s$ and the proceeds distributed over the new set of constituents in proportion to $n'_s p'_s$. If the value of new portfolio is denoted by $kn'_s p'_s$ then

$$\Sigma n_o\, p_s = \Sigma k n'_s\, p'_s \text{ and}$$

$$k = \frac{\Sigma n_o\, p_s}{\Sigma n'_s\, p'_s}$$

The value of the new portfolio at time t, assuming no further changes, would be

$$\Sigma k n'_s\, p_t = \frac{\Sigma n_o\, p_s}{\Sigma n'_s\, p'_s} \times \Sigma n'_s\, p_t$$

and

$$I_t = \frac{\Sigma n_o p_s \cdot \Sigma n'_s p_t}{\Sigma n'_s p'_s \cdot \Sigma n_o p_o}$$

$$= \frac{\Sigma n'_s p_t}{\Sigma n_o p_o \times \dfrac{\Sigma n'_s p'_s}{\Sigma n_o p_s}}$$

$$= \frac{\Sigma n'_s p_t}{\Sigma n_o p_o \times \dfrac{\Sigma n_o p_s + V_s}{\Sigma n_o p_s}}$$

where V_s is the increase in value of the shares involved in the capital change, i.e. $\Sigma n'_s p'_s - \Sigma n_o p_s$. In certain cases, such as a take-over or repayment of capital, V_s is negative.

Since there have been no capital changes between o and s and s and t, the formula can be written

$$I_t = \frac{\Sigma n_t p_t}{\Sigma n_o p_o \times \dfrac{\Sigma n_s p_s + V_s}{\Sigma n_s p_s}}$$

$$= \frac{\text{current market valuation}}{\text{adjusted base valuation}}$$

19. The above formula is fairly general. It is the same in form as that for the *Financial Times*-Actuaries Index. Thus, both the so-called fixed weight and current weight index numbers can be expressed symbolically in the same form. The results by each differ because the rules for capital changes differ. For example, in the case of a rights issue the usual rule for a fixed weight index is that sufficient of the holding, in respect of which there is a rights issue, should be notionally sold to purchase the rights on the balance of the holding. In the above formula, if α denotes the security affected then $n_\alpha p_\alpha = n'_\alpha p'_\alpha$ and $V_s = o$ so that $k = 1$ and the capital distribution is not altered. In the case of the current weight index, however, $n'_\alpha p'_\alpha > n_\alpha p_\alpha$ and V_s is positive and thus the capital distribution changes. If a security is deleted then in both cases the capital distribution becomes that for the remainder of the securities. The point is that in the fixed weight index changes are kept to a minimum, they are made only when there is no other procedure to follow. In the current weight index changes are made for these same reasons and also in order to keep it up to date, for example, when there are increases in capital and when it is considered that new or growing companies should be included in the constituents. It is only in this sense that the *Financial Times*-Actuaries Index can be called a currently weighted index. It might be thought that it would be reasonable to construct a current weighted index by the formula

$$\frac{\Sigma n_t p_t \dfrac{p_t}{p_o}}{\Sigma n_t p_t}$$

20. However, there are important objections to such a formula. It is difficult to interpret as a meaningful portfolio; it indicates the value at time t of a portfolio in which the cash amounts invested at the base date were proportionate to market values at time t. Further, if adjustments are not made there would be 'breaks' in the series when the weights change. Also it would be difficult to introduce new securities. If modifications are made to avoid these difficulties, presumably one would arrive at the *Financial Times*–Actuaries formula.

21. It is clear then that in practice the two extremes—fixed weights and current weights—are not practical possibilities and the *Financial Times*–Actuaries formula is a good compromise reflecting current conditions. It is also obvious that all indices require some kind of chaining process. One can say in effect that at each change of weights a new index is constructed. With the date of change as the base it is then 'linked' or 'tied' to the old series.

22. It must be considered whether this formula is suitable when there are group indices. Many index services provide indices for industrial groups in addition to a combined index, and it is not obvious that the same continuity rule can be applied both to the group indices and the combined index. It will be remembered that the general rule is that when the weights are to be changed the portfolio is sold at the prices just before the change and the proceeds redistributed in proportion to the new capital values just after the change. For a group index this means that the sale and redistribution is made for the group only, because if this was not done, continuity in the group index would not be maintained. On the other hand for the combined index the redistribution is made over all the constituents in the portfolio and it might be argued that this means lack of consistency in the indices as a whole.

23. Take the case of a capital increase in one of the constituents of group X. The general principle is that a proportionate amount of the shares in the index are 'sold' and the proceeds used to 'purchase' the shares of X in such manner that the individual capitalizations are proportionate to the new capitalizations required by the rules. If this is done for the group only, both in respect of the group index and the combined index, then the relative importance of group X in the portfolio is not changed but over all the constituents the new capitalizations used in the index will not be proportionate to the actual new capitalizations. If, however, in the case of the combined index the sales are spread over the whole portfolio, in accordance with the general rule, then the relative importance of group X is increased and there will be the inconsistency that the value of the group in the group index is not the same as its value in the combined index. It is easy to show that this amounts to saying that the combined index is no longer a weighted average of the group indices. This was true also for the Actuaries Investment Index (first series) but was avoided in the second series by making the combined index a weighted average of the group indices, the weights remaining

unchanged whatever the changes in individual constituents. This method would break down only if it was necessary to add or delete groups. Careful consideration was given to the question whether it was necessary for the combined index to be a proper average of the group indices. It is not necessary that the indices should be interpreted in this way, and, on balance, it was felt that the combined index should be adjusted in the same way as the group indices. Generally it seems reasonable to suppose that if the capital of a particular group is increased relative to that of other groups then its importance in the combined index should be increased and vice versa if the capital is decreased. For some problems of investment analysis, it would be more useful to have a proper average against which to compare the performance of individual shares. At any time t, I_t is not a criterion of the history of the constituents at time t, it is an indicator of the performance of a changing portfolio and its level has been influenced by securities which have been eliminated before time t. For comparison purposes, however, an analyst might wish to compare the performance of a constituent with that of the existing constituents only. An example of this is given in Part V.

PART II. DESIGNING THE FIXED INTEREST INDICES

24. The Actuaries Investment Index (Second Series) included seven price indices for fixed interest securities, namely:

$2\frac{1}{2}\%$ Consolidated Stock
Home Corporations.
Debentures:
  Investment Trusts.
  Breweries.
  Miscellaneous.
Preference:
  Investment Trusts.
  Miscellaneous.

In addition there was an index for 15–25 years redeemable debenture stocks calculated by a somewhat novel formula. In the *Financial Times*–Actuaries Index, the home corporations index and the irredeemable debenture indices have been discontinued and an index for redeemable British government securities, calculated on principles similar to that of the redeemable debenture index, has been added.

Debentures

25. The redeemable debenture index is calculated so as to maintain the average outstanding term at about 20 years. There are fifteen constituents divided into three groups of five, according to redemption date. The three maturity periods are 1976/80, 1981/85 and 1986/90.

For each group at time t the average $\frac{1}{5}\Sigma\frac{p_t}{p_o}$ is obtained. Then if these averages are denoted by I_{1t}, I_{2t} and I_{3t}, the index at time t is obtained from the formula

$$I_t = \frac{100}{2}\left(\frac{1460-t}{1825}I_{1t} + I_{2t} + \frac{365+t}{1825}I_{3t}\right)$$

where t is the number of days from 31 December 1961. It will be seen that the weight given to the first group gradually diminishes whilst that to the third group increases. At the end of four years a new group will be introduced if this is possible.

Government securities

26. The index for the redeemable government securities adopts a similar moving weight system, but in the first place the redemption yields are averaged. There are six securities divided into three groups, each of two securities, according to the same three maturity periods as used for the debentures.

For each group the mean of the two redemption yields at time t is calculated, and if these are denoted by Y_{1t}, Y_{2t} Y_{3t}, then the average yield for all the securities is calculated by the formula

$$Y_t = \tfrac{1}{2}\left(\frac{1410-t}{1705}Y_{1t} + Y_{2t} + \frac{295+t}{1705}Y_{3t}\right)$$

where t is the number of days from 31 December 1961. The numbers 1410, 295 and 1705 were calculated from the condition that the average outstanding term for all values of t should be 20 years precisely. For the price index the price is calculated for a 20 year stock with a 4% coupon to yield Y_t and the index I_t at time t is this price divided by the corresponding price at the base date, 10 April 1962, multiplying the result by 100.

Preference shares

27. The indices of preference shares have been constructed on the same lines as in the Actuaries Investment Index series, except that the price indices are now unweighted arithmetic averages of the price relatives instead of geometric averages. The method of selection was exactly the same as that set out in the Explanatory Memorandum for the Actuaries Investment Index (Second Series—revised), namely:

(1) Nominal amount in issue at least £1 million for investment trusts and at least £2 million for industrials.

(2) Stock must
   (a) be irredeemable
   (b) carry no participating rights as to either capital or income
   (c) not carry more than 25% of total voting strength
   (d) be subject to a net rate of U.K. tax not less than 4*s*. in the case of investment trusts and 7*s*. in the case of industrials

(3) Dividend must be:

(a) cumulative
(b) not tax-free
(c) well covered
(d) 6% or less

Subject to these conditions, the index constituents are selected so as to provide a reasonable spread over the different industrial groupings.

There are two price indices, the one being based on 15 investment trusts and the other on 20 industrial companies. They are unweighted arithmetic averages of the price relatives, the prices being net of accrued interest.

For the yields, unweighted arithmetic averages are calculated from the yields of the individual stocks in the two groups.

The fixed interest indices are considered from a practical point of view in Part III.

PART III. THE INDEX IN PRACTICE

Investment policy

(a) *The phase of the cycle*

28. The original theme of C. M. Douglas was that the business cycle is a vital factor in investment policy. Readers whose experience of finance is confined to the post-war period may feel that these cyclical movements are now of minor importance. Certainly the post-war scene has been dominated by inflationary forces and in general the trend of equities has been upwards, and of gilt-edged downwards. Now that the post-war shortages have been resolved and inflation is less prominent, more competitive conditions are likely to obtain and the business cycle may once again become important. The traditional investment theory was to buy equities at the bottom of the cycle when they were low and to buy gilt-edged at the top of the cycle when the high level of demand for capital had resulted in relatively high interest rates. This is an excellent theory provided the investor can correctly decide what phase of the cycle obtains at any particular time.

29. This question of using indices to study the progress of the business cycle and thus to determine investment policy, was discussed at some length in the previous paper (*J.I.A.* **82**, 339–47, and *T.F.A.* **23**, 388–97). An important technique is that described by A. G. Ellinger in his book *The Art of Investment*, and illustrated in Figures 1 and 2 of the earlier paper. These charts showed the progress of the four factors, dividend, confidence, fixed interest and activity from 1 January 1946 to October 1955. It is interesting to note that when checking the final proofs in October 1955 the authors looked at the charts and agreed that the classical signals of a bear market were evident. Confidence had turned down, fixed interest appeared to be declining, dividends had flattened, and markings were little more than

half their peak figure of 660 some months before. They were not then sufficiently confident of the technique to forecast the 30–40 point fall from 200 to 160–170 that was to take place by the time the paper was submitted five months later. To complete the historical record, these charts have been brought up to date, covering the period 1953 to 1963 inclusive (see Figures 1 and 2). Careful study of the charts around the period of the peak in 1957 and the trough of 1958 shows that in each case, within a short period of the turning point, and well before any major change had occurred in prices, dividends, fixed interest and activity were giving warning signals. In 1961, however, these indicators failed to give any advance warning of the sharp decline in the market.

30. This technique might well be improved if it were based on better statistics than the *Financial Times* 30 share and Fixed Interest indices. The 500 share index with its much wider coverage would be a more reliable indicator of dividend trends than the 30 share index which can be unduly affected by a single dividend change. The *Financial Times* Fixed Interest index can also be criticized, being a rather sluggish indicator of interest rate changes owing to the limited market in its preference and debenture constituents. The best index for this purpose is one based on gilt-edged stocks which are far more sensitive than debenture and preference issues. At first sight the Consols yield appears suitable, being the traditional pointer to long-term interest rates. Although automatically included in the indices because of their long history, Consols are really most unsatisfactory for this purpose as they are relatively inactive and are subject to considerable yield fluctuations relative to other undated issues. Treasury $2\frac{1}{2}\%$ is a much better guide to gilt-edged yields. Using this latter series the components of the 500 share index become:

$$\begin{aligned}
&\text{Index at 1 November 1963} && = 115{\cdot}24\\
&\text{Dividend Yield} && = 4{\cdot}13\%\\
&\text{Dividend} && = 115{\cdot}24 \times \frac{4{\cdot}13}{100} = 4{\cdot}76\\
&\text{Yield on Treasury } 2\tfrac{1}{2}\% && = 5{\cdot}525\%\\
&\text{Price index of Treasury } 2\tfrac{1}{2}\% && = \frac{100}{5{\cdot}525} = 18{\cdot}10\\
&\text{Confidence} && = \frac{5{\cdot}525}{4{\cdot}13} = 1{\cdot}338
\end{aligned}$$

Index	= Dividend	× T$2\frac{1}{2}\%$ index	× confidence
115·24	= 4·76	× 18·10	× 1·338

Figure 3 demonstrates the progress of these three factors plotted each week from 10 April 1962, to date. The earnings index is also shown on this chart. The 500 share index history is, of course, too short to enable these charts to be much use to signal the up-turn in the index which occurred in June 1962.

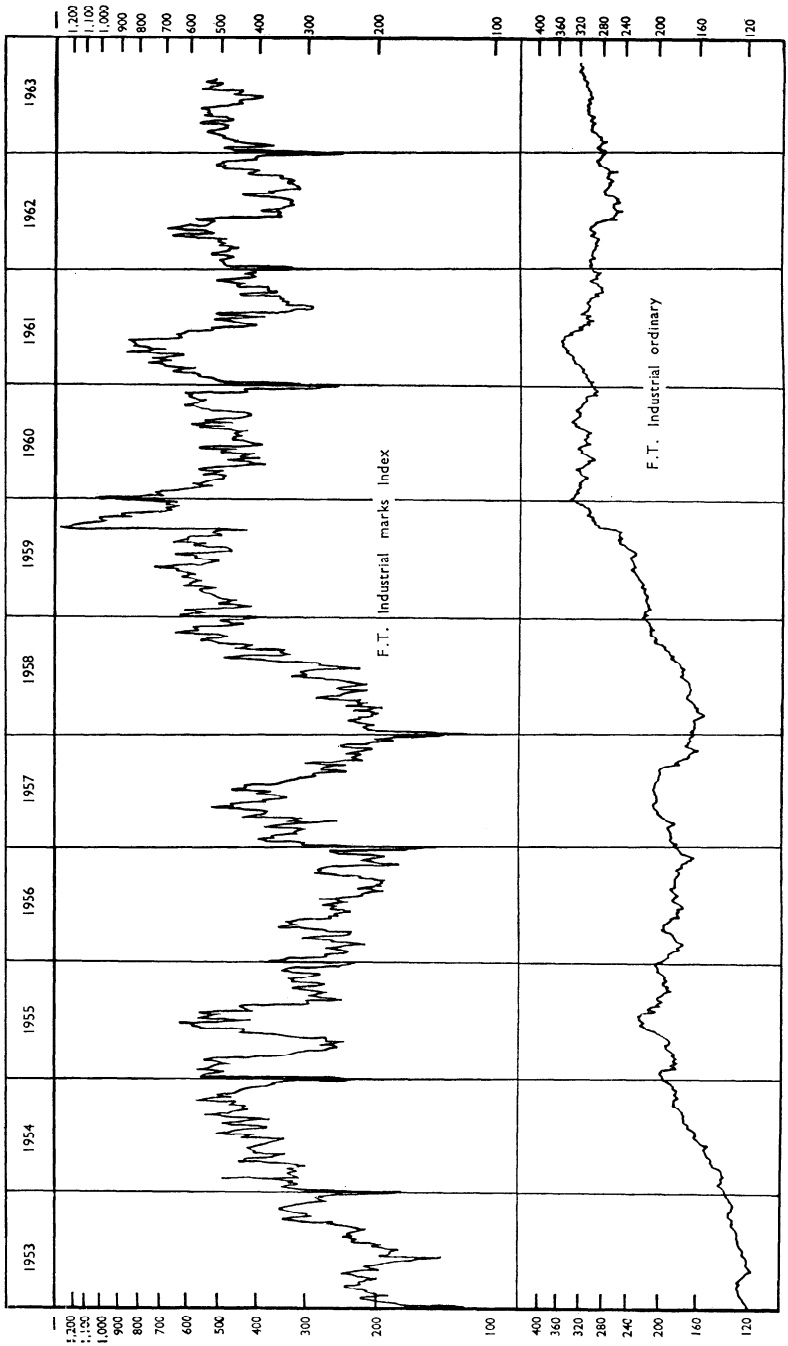
1953
1954
1955
1956
1957
1958
1959
1960
1961
1962
1963
F.T. Industrial marks Index
F.T. Industrial ordinary

FIG. 1

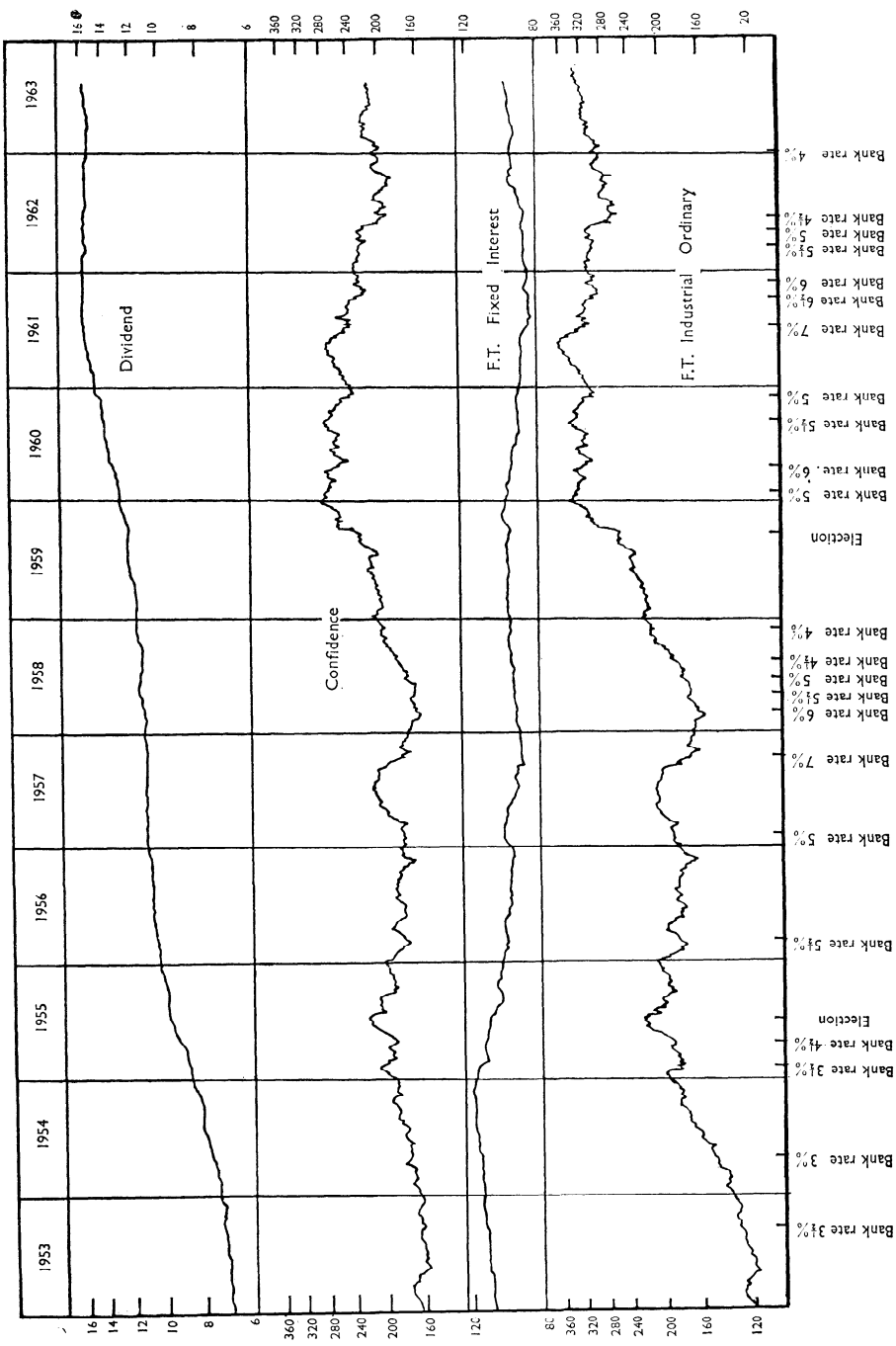
1953
1954
1955
1956
1957
1958
1959
1960
1961
1962
1963
Dividend
Confidence
F.T. Fixed Interest
F.T. Industrial Ordinary
Bank rate 3½%
Bank rate 3%
Bank rate 3½%
Bank rate 4½%
Election
Bank rate 5½%
Bank rate 5%
Bank rate 7%
Bank rate 6%
Bank rate 5½%
Bank rate 5%
Bank rate 4½%
Bank rate 4%
Election
Bank rate 5%
Bank rate 6%
Bank rate 5½%
Bank rate 5%
Bank rate 7%
Bank rate 6½%
Bank rate 6%
Bank rate 5½%
Bank rate 5%
Bank rate 4½%
Bank rate 4%

FIG. 2

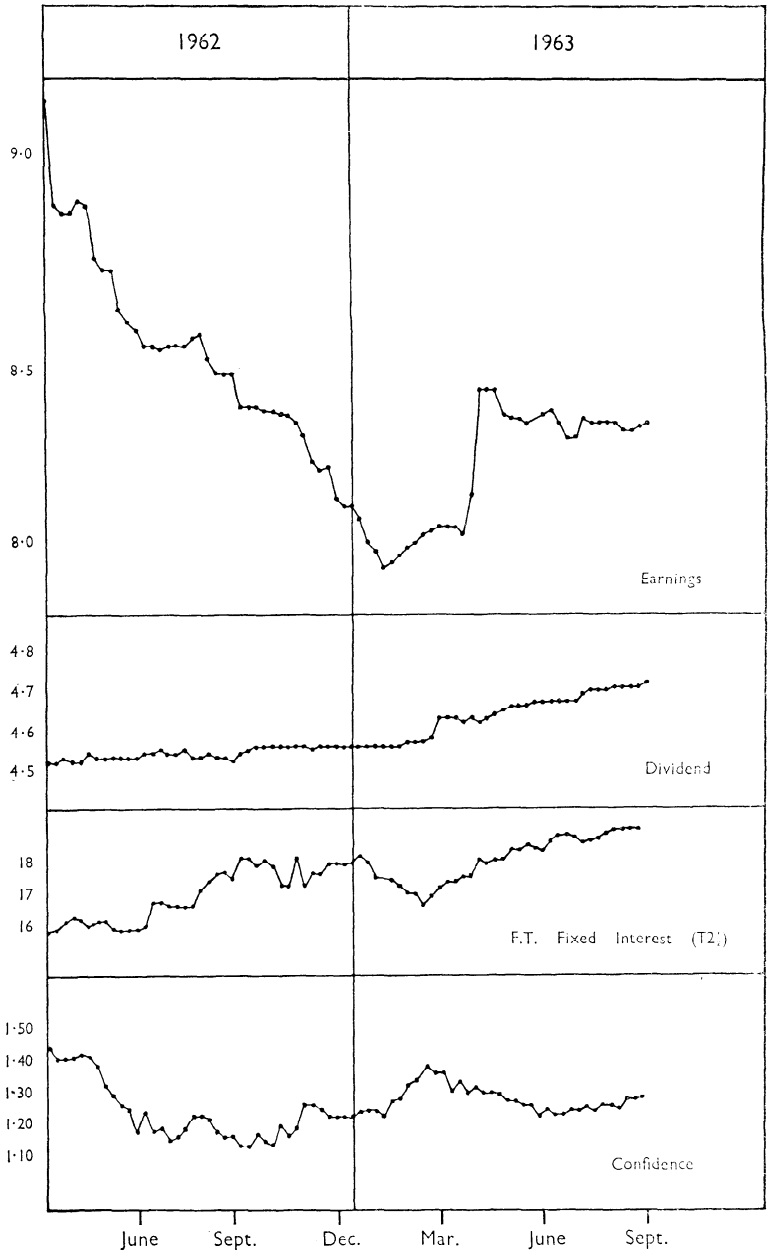
1962
1963
9·0
8·5
8·0
Earnings
4·8
4·7
4·6
4·5
Dividend
18
17
16
F.T. Fixed Interest (T2½)
1·50
1·40
1·30
1·20
1·10
Confidence
June
Sept.
Dec.
Mar.
June
Sept.

FIG. 3

31. Another forecasting system, not mentioned in the earlier paper, is the *Dow Jones* scheme widely used in America. This involves plotting side by side the *Dow Jones* 30 share index and an index of Railway shares. A significant change of trend in the *Dow Jones* if confirmed by the Rail index is often a precursor to a major move in the market. This technique has a certain logic behind it, as it is reckoned that any up-turn or down-turn in the economy is first revealed by rising or falling Rail receipts and by a corresponding movement in the Railway shares. In the U.K., with Railways nationalized, this method is impracticable.

32. In the earlier paper the progress of the share index was compared month by month with figures for dividends paid and 'earnings for Ordinary' from the *Financial Times* analysis of the reports received from 3000 companies. This study revealed that the turning point of the dividends was invariably before those of the earnings and often before the corresponding moves in the share index itself. This is not surprising, because at the time of dividend declarations the Directors' decision is based not so much on earnings for the previous year (now many months out of date), but on the latest business trends, which are not yet known to anyone else. In 1956, in default of satisfactory comprehensive dividend and earnings indices, the *Financial Times* tables had to be used for this demonstration. Now that these series from the 500 share index are available, the same features are revealed, the dividend turning well before the earnings (see Figure 3 where dividend can be seen to turn up in September 1962, and earnings in January 1963). Consequently, there seems no need to bring up to date the tables derived from the *Financial Times* analysis as any signals they may give are better derived from the 500 share dividend and earnings indices.

33. Finally there are certain systems which compare the progress of a share index with, say, a twelve months' moving average of the same factor. Naturally when the indices are rising the latest figure will be higher than the moving average, whilst in a declining market the current index will be lower. The theory is that when the moving average line cuts the index line a major change is to be anticipated. This system appears to have no economic justification. It is really little different from the Hatch Theory which recommends purchases 10% up from the low point of the index and sales 10% below the high point. Both these methods are merely mechanical devices which cannot fail to signal the onset of a substantial upward or downward trend, some time after this move has commenced. The trouble is that these signals will often be given on the strength of secondary movements which do not persist.

(b) *The selection of groups*

34. The group indices show how a representative portfolio of shares in a particular industrial group has fared as to price performance, dividend record and earnings. This, of itself, is no more than historical information revealing in a convenient form what an experienced market operator would

know already. The absolute performance of a group index is of little interest; what matters is how it has moved relative to some standard, either the 500 or 594 share index, or the capital goods or consumer goods index, etc., whichever is most appropriate. For example, the building group index now stands at 114 as does the 500 share index; hence this group has moved with the market and is not, therefore, displaying any special features. On the other hand, the composite insurance share index stands at 76 so that this group has moved completely against the general trend. This result may well reveal a special situation worthy of further investigation.

35. The analyst who is looking for under-valued and over-valued classes will need to keep charts of some or all of the group indices, watching their performance relative to the whole index. Such charts will probably be maintained weekly as a daily tabulation is scarcely necessary for this purpose. This chart programme would logically start with the 'class' groupings (the capital goods, the consumer durables, the consumer non-durables, the chemicals, oil, etc.) comparing their price performance with that of the 500 share index. This series, with its earnings yield, is a more suitable standard than the 594 share index. One method is to chart these five or six series in different colours on the same sheet of graph paper keeping the 500 share index either in heavier lines on the same paper or on an adjacent transparent sheet to facilitate comparisons. A preferable alternative is to chart (class index $\div$ 500 share index), thus showing directly the relative performance. An example of this technique is given in Table 1 below.

36. Table 1 depicts the performance of 'capital goods' and 'consumer goods' both relative to the all shares index from 1953 to 1962 (for this purpose the old Actuaries Investment Index has been used, as the new series does not cover a long enough period). From December 1953 until 1955 'capital goods' went ahead as the boom in capital equipment trades developed, whilst 'consumer goods' lagged behind. Subsequently, however, the relative position of capital goods deteriorated whilst that of the consumer trades improved. The table demonstrates the cyclical nature of the capital goods trades and shows the scope that exists for tactical switches between this group and the consumer goods classes. This type of operation is surely what was envisaged by Douglas and Murray when planning the original index.

37. When a price index for a class diverges from the overall average the reason may be either an increase or decrease of the dividend relative to the average, or alternatively, a change in the market rating of the class. It is important to distinguish between these causes by watching the progress of the dividends and yields. The most convenient way to do this is to chart the 'yield relative', being the ratio of the class yield to that of the 500 share index. Changes in this 'dividend yield relative' may be due to the variations in the earnings so that it may also be necessary to record the earnings yields in a similar manner. Indices involving earnings, however, need to be interpreted with considerable discretion as a low figure for the earnings yield may reflect either a better growth rating or a decline in the profitability.

In § 32 above the possible value of indices of dividends and earnings was discussed; it was suggested that the dividend index in particular gives an earlier warning of changing industrial conditions than does the earnings index. Again it is the dividend performance relative to the 500 share index that matters and should be studied on suitable charts.

38. So far only the major class groupings have been discussed. Clearly the individual industrial groups could with advantage receive similar treatment. Their index figures for prices, dividends and yields should be plotted

Table 1. *Capital goods versus consumer goods. Group indices ÷ all share index*

Date	Capital	Consumer
12/53	·988	1·180
6/54	1·051	1·114
12/54	1·048	1·108
6/55	1·166	1·013
12/55	1·150	·994
6/56	1·099	·934
12/56	1·071	·950
6/57	1·053	·923
12/57	1·000	1·000
6/58	·952	1·010
12/58	·984	1·065
6/59	·956	1·150
12/59	1·010	1·174
6/60	·966	1·217
12/60	·904	1·284
6/61	·902	1·315
12/61	·853	1·379
6/62	·833	1·366
12/62	·819	1·274

against the most suitable standard which would usually be the appropriate class groupings.

39. The best results from index charts are achieved by plotting them alongside charts of various economic factors depicting the progress of the groups concerned. The Monthly Digest of Statistics has many examples of suitable series—production statistics, numbers employed, orders outstanding, retail sales, hire purchase debts, etc. The *Financial Times* monthly figures of industrial profits, earnings for ordinary, and dividends can also with advantage be studied alongside corresponding index figures. It is clear that the value of the index display is enormously enhanced by keeping the relative figures on well-designed charts. For the large number of industrial groups maintenance of the necessary charts even on a weekly basis is an onerous task and it is highly wasteful and uneconomic for all the interested parties to have to set up their own chart library. Clearly there is a case here for some organization being prepared to design suitable charts,

to reproduce them and to issue them on a subscription basis. It is interesting to note that in America an enterprising statistical service provides a continual coverage on a weekly basis of these price relative charts both for industrial groups and for many individual shares. Subscribers receive a new set of charts each week. As an alternative the charts are reproduced on micro film and can be inspected by the subscriber on a suitable projector.

40. An interesting example of the movement of an industrial group index is given in Figure 4 which shows the dividend yield of the electrical engineering group relative to the all industries yield (the figures are taken from

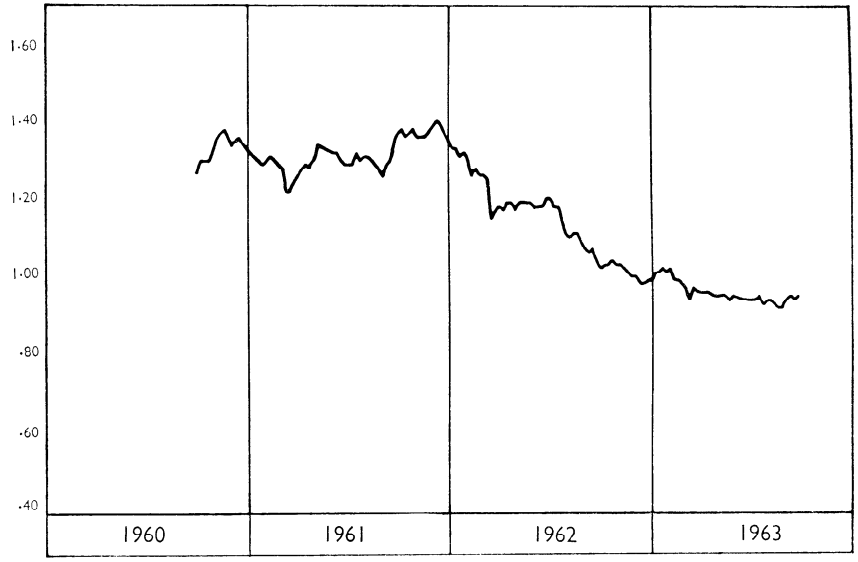

FIG. 4

the Airways* 600 share index available since 1 July 1960). From 1 July 1960 to 31 December 1961 the yield rating of this group was between 1·20 and 1·40 reflecting the poor dividend performance of the leading companies in this trade and the apparently limited growth prospects of their shares. In January 1962 the severe weather and the consequent electricity cuts began to suggest that the capital plans of the Central Electricity Generating Board would have to be enlarged and the rating moved down below 1·20. In June 1962 news of the large new contracts for generating plant, etc., was announced; immediately the yield rating broke through the low of 1·16 and thereafter declined steadily to the present level of 0·95. An analyst watching both the charts and the news of these trade developments might have been able to forecast the spectacular recovery in this group of shares soon after it commenced in June 1962.

* See Section 87 for further details.

Portfolio performance

41. One of the primary objects of the index is to provide a 'standard portfolio' suitable for checking the results of all types of investment activity. For 200 years actuaries have been constructing mortality tables, and using them to check the success of their methods of selecting lives for assurance. So far, however, there has been little professional interest in the construction of 'investment tables' or share indices, designed to check the selection of ordinary share investments—a problem now perhaps of equal importance!

42. The original sponsors of the Actuaries Index (Douglas and Murray) were concerned with tactics and policy rather than portfolio performance. In the previous paper this question was dismissed in a couple of paragraphs. In any event, the original Actuaries Investment Index with its infrequent publication, its limited weighting procedures, and its geometric averaging was a far from satisfactory standard for this purpose.

43. The *Financial Times* 30 share Index, however, with its daily quotation, has been widely used as a check on the price performance of life funds, investment trusts, unit trusts, etc. Sometimes, annual reports mention how much better the results have been than the index. Such comparisons are rarely published when the results are adverse! Now that alternative daily indices are available, the 30 share index should no longer be so used, except perhaps for short term comparisons. Over a period of, say, more than a year the 30 share index will normally lag behind wider-based and more representative series because:

(1) The geometric averaging makes for a downward bias.
(2) The shares concerned, having been selected 30 years ago, are not perhaps fully representative of the new and growing industries.
(3) The 30 constituents representing the industrial 'giants', may have below average scope for growth, merely because of their size.

44. In fact, former index techniques, designed for manual computation, simply did not permit the construction of a daily index acceptable as a performance standard. The new *Financial Times*–Actuaries index does, however, represent a 'standard portfolio' invested in some 500 equities, each holding being proportionate to the market valuation of the company concerned. This 'portfolio' is kept up to date by subscribing to all 'rights' issues and substantial new flotations, raising the money required by selling equal fractions of all earlier holdings. The investment policy is similar to that of an institution, which holds a percentage of the capital of 500 equities and has sufficient new money to take up all rights and subscribe for new issues, but which never sells existing holdings. Such a portfolio, with its passive non-selective policy, should form an excellent standard against which the results of managed portfolios can be measured.

45. The existence of a reliable 'standard portfolio' introduces a new and stimulating discipline into investment management. It may well become

normal actuarial practice to check not only the mortality experience, but also the investment performance. Like mortality figures, affected by unexpected claims, the results will fluctuate from year to year, due perhaps to a few poor investments. Hence, results of a single year will have little significance; if, however, year after year, the performance of a managed portfolio continues substandard, surely there is something wrong with the policy, the day-to-day management or both!

46. This valuable discipline should also be applied to other types of investment work. In a stockbroker's office, the statistical department may be responsible for a steady output of recommendations for purchases or sales. Financial journalists, writers of weekly news letters, investment counsellors, etc., perform similar services. When the objective is merely short-term capital gain, the value of all those recommendations can now be readily checked, by allowing say 12 months to elapse, and then scaling the prices at the date of the suggestion up or down by the movement of the index, comparing the result with current market prices. It is to be hoped that the 'purchases' will perform better than the index, and the 'sales' somewhat worse: if the reverse situation obtains, the authors of the recommendations can scarcely escape criticism.

47. When clients' portfolios are managed by a trustee office, a merchant bank, or a stockbroker, the performance should be checked against the index at intervals. Investment trusts and unit trusts, which have traditionally been using the *Financial Times* for comparisons, will usually find it much more difficult to 'beat the index', if the *Financial Times* Actuaries is used as the standard. For these classes, the emphasis is more on the long term results, so that any tests of performance must allow suitably for dividends as well as capital. Space does not permit of a discussion in detail on the methods of checking portfolio performance. The procedure as regards a growing pension fund is described in the *Investment Analyst* No. 3, August 1962, 'Measuring Ordinary Share Portfolio Performance' by A. B. Gilliland. This excellent article shows how to compare each quarter both the capital and income performance with a suitable index standard. It is important also to study the yield on the market values. Clearly an investment policy, directed towards the lower yielding 'growth' shares, should secure above average growth in capital and income: this result may not necessarily be better than that of an alternative portfolio, with less growth but higher income. There is considerable scope for research into methods of comparing the results of high and low yielding portfolios, allowing for capital and income combined.

Historical studies

48. Two important index applications are:

(a) Assessing the yield gap between gilt-edged and equities and
(b) Studying the long term progress of equity prices and dividends compared with other factors such as wage rates, living costs, etc.

The first application requires a long-term dividend and earnings yield series. With a narrowly based index of say 30 shares, changes in dividend and earnings from a single company following the Annual Report, may make a significant difference, introducing a distinct break in the figures. For continuity over a long period the constituents need if possible to be left unaltered. If, perhaps following a takeover, a constituent has to be replaced the new one is most unlikely to carry the same dividends and earnings yields as the old one. Hence such a change makes again for a break in both dividend and earnings series. As changes are such a nuisance they are best kept to a minimum with the result that the constituents become outdated and unrepresentative. This is, in fact, now the case with the *Financial Times* 30 share index which includes an excessive proportion of constituents from the engineering and textile trades with above average dividend yields and probably sub-normal growth prospects.

The effect of these constituents on the yield at 1.11.63 is shown below:

	Dividend yield %	Earnings yield %
30 share	4·53	5·82
500 share	4·13	7·19
Oil group	5·56	13·20
'500 share' ex oil	3·95	6·43

49. As the 30 share index does not include the high yielding oil shares, these are best removed from the 500 share index before making the comparisons. By reference to the adjusted 500 share index the smaller index shows a dividend yield some ½% higher and an earnings yield of ½% lower. Consequently, any attempt made to bring the 30 share constituents up to date would automatically mean replacing some of the high yielding capital goods shares by lower yielding constituents; the result would be that the dividend and earnings yields would change sharply, probably in opposite directions. Such changes would probably destroy all confidence in the index as a yield criterion.

50. In contrast, the 500 share index, with its automatic procedure for keeping the constituents up to date, is likely to prove much superior as a yield standard. With the very large number of shares involved, changes among the individual constituents have a negligible effect on the overall result. By the use of weighted averages, kept automatically up to date with capital changes, yields are maintained as thoroughly representative of the returns available from a comprehensive sample of U.K. Industrial shares.

51. The second application, comparing share prices with wage rates, etc., was dealt with in the previous paper (see *J.I.A.* **82,** 351, Table 5, and *T.F.A.* **23,** 401). An up-to-date version of this table is now reproduced below.

For the Actuaries Index mid-year figures are taken. The figures for the other four series are yearly averages of monthly figures. The figures for

wages differ slightly from those given in the earlier paper, as this series was revised in 1958.

The *Financial Times* 30 share index has replaced the *London and Cambridge* index, discontinued in 1950. The earlier table showed how by 1955 the old Actuaries Index had fallen behind both the *London and Cambridge* and the *Investors Chronicle* Indices, for the next seven years this lagging tendency still obtained. Probably the sub-normal long-term performance of the Actuaries Investment Index is due to inclusion of railway shares up to 1948 and to the heavy weighting given to the slow-moving tobacco group thereafter. The *Investors Chronicle* index shows the greatest

Table 2. *Share prices, costs and wages*

Year	Actuaries	*Financial Times*	*Investors Chronicle*	Retail prices	Wages
1930	100	100	100	100	100
1935	103	124	120	91	97
1940	52	89	65	118	119
1945	114	149	152	147	159
1950	102	144	140	180	196
1955	176	253	241	240	268
1956	153	235	216	251	288
1957	174	245	230	261	303
1958	158	236	239	269	312
1959	210	324	355	270	321
1960	257	414	453	273	327
1961	277	415	508	282	341
1962	230	371	483	294	351

appreciation over the 33 years. This spectacular price performance is to some extent explained by the method of averaging (arithmetic for *Investors Chronicle*, geometric for *Financial Times*). Over the whole period Ordinary Share prices as measured by the *Investors Chronicle* and the *Financial Times* appear to have outpaced retail prices and wages. This statement must be treated with some reserve, however, as the choice for the base year of 1930, when equity prices were so low, contributes considerably to this result.

52. The 500 share index is of course too 'young' for any long-term comparisons to be made. Nevertheless, it is interesting to see how it has progressed so far relative to the other important indices. In Table 3 all the other indices have been recalculated to a common base of 100 on 10 April 1962.

The poor price performance of the 594 share index is readily explained by the continued weakness of the financial group (for this class the index in November 1963 was no more than 82 compared with 115 for the 500 share index). The *Daily Mail* index includes some financial shares and thus shows a somewhat lower figure than both the *Times* and the '500 share'. The latter two indices have kept close together over the whole period. To some extent the lead shown by the 500 share index may be ascribed to the

oil shares which carry a weight about one-tenth of the whole 'portfolio', and have performed much better than the average. The index for this group at 1st November 1963, is 149 compared with 115 for that of the 500 share. Ignoring the Oils, the 500 share figure at around 112 would be some 3% lower, just below the 30 share result.

53. The authors were distinctly surprised at this result, as they expected that the geometric averaging of the smaller index would have given it a downward bias relative to the new series. To explain this situation some calculations have been made based on the 30 share index, details being given in the Appendix. For this purpose, price relatives adjusted for capital

Table 3

Date	*Financial Times* 30 share	*Times*	*Daily Mail*	*Financial Times*–Actuaries 500 share	594 share
1.5.62	100·23	100·19	101·58	101·00	102·19
1.8.62	85·06	87·67	88·37	87·97	86·87
1.11.62	90·08	92·08	91·59	92·74	91·22
1.2.63	95·17	98·75	98·36	98·98	95·11
1.5.63	101·89	103·75	102·53	103·97	98·87
1.8.63	101·99	104·50	102·34	105·36	99·51
1.11.63	113·30	114·78	108·91	115·24	107·26

changes, etc., were taken for the 30 constituents from the weekly statistics of the Airways index, the relative dates being 11 April 1962 and 6 November 1963. Then the unweighted geometric average of these relatives was calculated, the result being 1·1246. Mutiplying this figure by the index on 11 April 1962 (305·3) gave a figure for the index on 6 November of 343·3 compared with the published figure of 343·8. From this material it is easy to recalculate the 30 share index on 6 November on alternative assumptions:

	Price relative	Index
1. An unweighted arithmetic average	1·169	357
2. A weighted arithmetic average	1·204	368

The 30 share index, if arithmetically averaged, would be standing some 14 points higher. The alternative weighted average is not a very suitable measure for a narrowly based index as it is unduly influenced by the above average performance of the large constituents. Imperial Chemicals with a price relative of 1·229 has a market value of £900 million, almost one-fifth of the total value of the 30 constituents. Woolworths, with a market value of £600 million, also shows an above average appreciation with a price relative of 1·249. From the figures given in the Appendix it will be seen that the leading constituents, from the point of view of price performance, are:

	Price relative on 6.11.63.
G.E.C.	2·289
P. & O.	2·277
Courtaulds	1·742

These three shares with their spectacular performance over the period concerned have had a distinct influence on the index. If instead of these particularly successful constituents other companies had by chance been chosen with a performance no better than the average, the 30 share index would not be 6½% or some 23 points lower than the current level of 343. Hence it appears that the close coincidence of the 30 share index with the 500 share one (less the oils) may be due to special circumstances and is unlikely to persist in the future.

Economic surveys

54. There is much talk in political and economic circles of a planned economy where wages, profits, dividends, etc., will be controlled in line with the progress of national productivity. Certain European countries, notably France and Sweden, have attempted to plan their economies in this way.

55. The first requisite to any scheme of this sort is a proper statistical coverage of all the factors involved. The progress of wages can be readily followed from the Ministry of Labour indices as well as from trade union and industry statistics. Profits and dividends, however, are not so conveniently tabulated and some confusion exists regarding the best indicators to use for these factors. Sometimes Board of Trade or Inland Revenue statistics are quoted: alternatively, reference may be made to the *Financial Times* monthly analysis of company accounts or to the corresponding quarterly tables of the *Economist*. Information from all these sources, however, is most misleading if used for comparison with wage changes as all these figures ignore the earnings on the new capital that is being raised from shareholders. Surely the more correct picture would be obtained by studying the movement of earnings and dividends received by those shareholders who maintain their original stakes without finding any new money. The only source of such information is a properly calculated and weighted index covering sufficient companies so as to represent an important section of British industry. In Table 4 profits and dividends are shown from 1960 to the present time both by the *Financial Times* tables and by the most comprehensive index that was available over the period concerned (the Airways 600 share index which commenced on 1 July 1960).

Columns 2 and 3 have been calculated by taking the ratio between the cumulative figures for January to December from one year to the next as the links in a chain index. The Airway figures are earnings and dividend indices recorded at the dates concerned relative to the corresponding figures at 31 December 1960.

56. Whilst the *Financial Times* tables show dividend increases of some 3% during 1962, the more correct assessment based on the index reveals that dividends were in fact frozen during that year. From January 1961 to November 1963 the annual growth rate of dividends measured by the index is no more than 2½%, compared with 7% per annum shown by the

Financial Times tables. From column 6 it is clear that wages continued to rise over this period despite the fall in earnings and the one year 'dividend freeze'.

57. Whilst the figures in columns 4 and 5 reflect correctly the experience of the equity shareholder it is arguable that this may not be the proper criterion to use when concerned with national economic planning when the problem is one of 'dividing the cake' between Capital and Labour. For this purpose a more correct concept is the return by way of earnings and dividends on a fixed amount of equity capital or 'capital employed'. On this basis in a static economy with national production, wages and the return on equity capital constant, the shareholder would

Table 4. *Profits, dividends and wages.*

	Financial Times tables		Airways indices		
Date	Net profits for equity	Net dividends	Earnings	Dividends	Wages
(1)	(2)	(3)	(4)	(5)	(6)
1.1.62.	106·0	112·5	98·7	104·0	104·1
1.1.63.	95·6	116·0	85·0	104·3	107·1
1.11.63.	96·3	123·1	87·0	107·0	109·7

nevertheless receive some additional income from the earnings on the ploughed-back capital. This additional income would, in fact, be no more than a recompense for conservative dividend pay-outs in previous years. If this theme be accepted then in a year like 1962 when overall dividends are frozen the shareholder is not just maintaining his position, but is actually taking a cut in the return on his capital employed. At present no satisfactory figures exist to measure the return on capital employed so that discussion on this subject is somewhat academic. The authors consider that the return on capital employed is a strong candidate for inclusion in the index display, as this feature is valuable for investment analysis as well as for economic studies. This question is discussed further in Part IV below.

58. In due course, as its history builds up, the 500 share index should be used as a guide for economic planning. For this special purpose it must be admitted that the oil shares would be better eliminated as they carry considerable weight and with their trading operations largely outside this country their activities have little influence on the U.K. economic scene. Consequently, consideration might be given to producing at say monthly intervals an adjusted index without the oil shares.

Approximate valuations

59. In the past the index has been used for making approximate valuations of institutional ordinary share portfolios. Accurate valuations would be made at annual or half-yearly intervals and the index figures, used if necessary in groups, would be employed to carry these valuations forward

month by month and so give approximate valuation figures at intermediate dates. This process did in fact usually work with reasonable accuracy if proper adjustments were made for the profits and losses on sales and for the cost of purchases.

60. For many institutional portfolios, market values are at present well above book values, following the appreciation of the ordinary shares, so that frequent valuations are no longer so necessary. In addition more and more institutional portfolios are now being valued by computers so that the value of the index for these purposes is much lessened. One such application does, however, remain. In assessing the break-up value of investment trust shares the published market values at the latest accounting date need to be brought up to date by the use of indices. With world-wide portfolios it is necessary to apply the appropriate national indices to the different sections of the portfolio. The new and more comprehensive weighted index should be a much better measure than the *Financial Times* 30 share index for this purpose. In particular, the 594 index has the advantage of including oil shares, insurance shares and bank shares, none of which appears in the 30 share series.

Preference share indices

61. These indices are useful as a guide to the investment policy to be adopted towards fixed interest securities. It is instructive to maintain a table or chart showing the long-term comparison between preference share yields and the returns on undated gilt-edged, taking for this purpose $2\frac{1}{2}\%$ Treasury. Table 5 sets out this comparison for the last five years of the old preference index. These figures can be used as a standard for the new series as the methods of construction and the constituents have hardly changed.

Over the five years 1958 to 1962 inclusive the Preference/Gilt-Edged yield ratio has varied between a 'high' of 1·27 on 29 July 1962 and a 'low' of 1·09 on 27 June 1961. With these wide variations in the relative yields there is some scope for switches between these two classes, selling preference shares against undated gilt-edged when the ratio is around 110 and reversing the transaction when the high figure of 125–127 is reached.

The present margin between these yields is some 13% (November 1963). In considering this margin it must be borne in mind that the index yield is based on middle prices and ignores expenses. For the yield to a buyer it is necessary to reduce the index figures by some 4%. Hence the difference between the buyer's yield on preference shares and on gilt-edged is at the moment no more than say 9%. Such a margin is low bearing in mind the lack of marketability and the degree of industrial risk associated with the shares. It is surely quite inadequate for a gross fund, as to these industrial risks, etc., are added the possibility of an adverse net U.K. rate which if it falls to 5/9*d.* involves a 10% loss of income and absorbs all the margin.

62. The investment trust preference index now always shows a higher

yield than the industrial share preference index. At first sight this is somewhat surprising because trust preferences are normally regarded as of higher quality than industrial issues. The explanation lies in the low net U.K. rates applicable to the trust preference shares which have the effect of making them unsuitable for gross funds and unattractive to many 'life and annuity' funds.

Table 5. *Preference and gilt-edged yields*

Date	Preference yield (1)	Treasury 2½% yield (2)	Ratio (1) ÷ (2) (3)
25.3.58	6·36	5·29	1·20
24.6.58	6·40	5·11	1·25
30.9.58	6·21	5·00	1·24
30.12.58	6·22	5·12	1·21
31.3.59	6·18	5·07	1·22
30.6.59	6·21	5·06	1·23
29.9.59	6·17	5·28	1·17
29.12.59	5·76	5·28	1·09
29.3.60	6·03	5·48	1·10
28.6.60	6·52	5·75	1·13
27.9.60	6·58	5·78	1·14
28.12.60	6·59	5·88	1·12
28.3.61	6·90	6·15	1·12
27.6.61	7·13	6·55	1·09
26.9.61	7·60	6·65	1·14
27.12.61	7·60	6·71	1·13
27.3.62	7·31	6·29	1·16
26.6.62	7·35	6·30	1·17
26.9.62	7·02	5·61	1·25
27.12.62	6·73	5·66	1·19
Average	6·64	5·71	1·17

63. The index could, with advantage, be used for pricing the occasional important preference share new issues. A more frequent application lies in determining the attraction or otherwise of market offers of preference shares. For example, the index figures may suggest that the margin between the gilt-edged yield and the yield after expenses of purchase of good quality preference issues is some 9–10%. If a buyer insists on say 20% above the gilt-edged yield only inferior stocks will normally be obtainable.

64. The question now arises whether the preference share index, being more or less identical with the old manual series, calls for any development in the light of the electronic facilities now available, which can allow automatically for any number of added refinements if these should prove of value to investors. Examples of such refinements are:

(a) separate indices for high and low coupon stocks
(b) special indices for shares with a full 7/9*d.* rate of net U.K. tax
(c) a degree of weighting by size of issue
(d) some classification by quality as measured by the dividend cover

Consideration might be given to enlarging the list of constituents, as 15 or 20 shares are scarcely enough to make a reliable average, if even a single constituent should deteriorate in status.

Redeemable debentures

65. The present series is in much the same form as the manually computed index, published by the Actuaries since 1957. Now that institutional portfolios can so readily be valued by the computer the original purpose of this display, making approximate valuations, has largely disappeared. The price index, as published, is of little use for timing purchases or pricing issues as the term of the stock concerned will usually differ from the 20 year period used for the index. In the circumstances, this index seems to serve comparatively little purpose and unless some readers have strong views and use it frequently the series might be discontinued. Before taking this step, however, some thought should be given as to whether any more useful service should be provided, such as the average redemption yields. This indicator which can now be so readily calculated by the computer would be of distinct value in demonstrating the gap between gilt-edged yields, as shown by the Government stock index, and debenture yields and hence possibly facilitating policy decisions regarding debenture purchases. The main difficulty lies in the very limited market in almost all debenture stocks once they are fully paid and subject to stamp duty. Only the largest issues show daily dealings in the *Official List*; for the majority of debentures jobbers quote 5 or 10 point prices which are only rarely changed. More frequent dealings occur in those issues where there is a substantial sinking fund but such stocks are likely to have unrepresentative yields and need to be excluded from an index service. The reduction in stamp duty from August 1963 may make for more active dealings in these stocks, and narrower price quotations. In these circumstances the possibility of redemption yield averages might be reconsidered.

The Government security index

66. Like the redeemable debenture scheme the Government security index is designed to reflect the experience of dated stocks with an outstanding term to maturity of 20 years. Yield comparisons cannot be made as the debenture index deals with price movements only. The relative price performance can however be studied and at the time of writing the position is as follows:

		Price indices	
	On 1.11.63.	'High'	'Low'
Debentures	113·01	113·43 (23.10.63)	98·98 (3.7.62)
20 year Government	114·23	115·42 (11.9.63)	99·91 (11.5.62)

As would be expected by comparison with gilt-edged, the debentures are rather less volatile and their 'highs' and 'lows' occur somewhat later.

67. Another application of the Government security index is to make a comparison between the 20 year yield and the Consols yield. Such a comparison reveals the slope of the yield curve from the 20 year point onwards and may in time develop into a series of some historical interest.

68. Whilst the debenture index may still be used by some investors to make approximate valuations, no such application can be envisaged for the gilt-edged index as an accurate valuation of the few stocks involved can always be made so readily.

69. The authors are of the opinion that the mere calculation of the 20 year Government stock yield by a crude process designed for manual calculation is scarcely making proper use of the electronic computer. This single yield gives only a very limited picture of the gilt-edged scene and will scarcely ever be used by institutional holders of gilt-edged whose statistical needs are already so fully catered for by the extensive records kept by the leading firms of stockbrokers specializing in gilt-edged. The daily redemption yield list obtained from these stockbrokers is often kept in a file so as to provide the full story of relative redemption yields for stocks of different terms over the years. From these records of redemption yields the yield curve (the redemption yield plotted against the term) is readily obtained. This yield curve if recorded at say monthly intervals provides practically all that is likely to be needed for historical and tactical studies of the gilt-edged market.

70. In the circumstances the question arises as to whether the gilt-edged index service should not be extended to include a calculation of the yield curve and the publication of redemption yields at, say, quinquennial intervals throughout the list. The procedure for using an electronic computer to fit a curve to the redemption yields of Government stocks has been fully described in a recent paper by G. T. Pepper (*J.I.A.*, **90,** 63).

PART IV. FURTHER DEVELOPMENTS

71. With the electronic computer, there is no need to limit the index display just to prices, dividends and earnings. There are several other factors, used in investment analysis and in economic research, which could with advantage be included in the programme. The most important factor is the 'assets per share'; others that merit investigation are the depreciation per share, the 'cash flow', the level of stocks, and the capital expenditure. These items might perhaps be the subject of a special monthly tabulation, as they do not change quickly enough to justify daily tabulation.

72. If the 'assets' (i.e. assets per share) were tabulated, much valuable analytical material would become available. The ratio assets ÷ price denotes the goodwill element in the share valuation, and allows for interesting comparisons between different companies in the same industry, and between various industries. Earnings ÷ assets, and dividend ÷ assets reflect the returns obtained on the capital employed in the business and are

important factors in assessing a company's prospects. In addition, these ratios may have important social and political implications, as mentioned in § 57 above.

73. The ratio assets ÷ price has a further interesting application. It is one of the components of the earnings yield as shown below:

$$\text{earnings yield} = \frac{\text{assets}}{\text{price}} \times \frac{\text{earnings}}{\text{assets}}.$$

So far, little is known regarding the use of earnings yields in investment analysis. Now that earnings yields have become part of the index display, a new field of research is opened up, investigating questions like the relation between past earnings yields and subsequent performance. Such studies could well be facilitated by examining the components of the yield; for example, splitting up index constituents into those with

either (a) substantial assets carrying a low return

or (b) low assets employed more profitably.

74. A possible technique is to construct an index of asset values, commencing at 100 on the base date, with earnings yields and dividend yields on these assets. The whole scheme would be similar to the existing display, with asset values substituted for prices. If such an asset value index was indeed available over a period of years, it would be most instructive to compare its performance with that of the price index under different economic conditions. Probably the ratio asset index ÷ price index would display interesting long-term trends, reflecting changes in the profitability of industry, and in shareholders' expectations. The 'highs' and 'lows' of the ratio, occurring presumably at low and high points of the trade cycle might well be a useful additional guide to the timing of equity purchases.

75. It will be seen that the assets ÷ price ratio is always the significant factor. In these circumstances it is clearly better to work direct on this ratio, rather than to use the asset index. The ratio would be calculated for each constituent as well as being averaged for each group, and for the whole index. The progress of this ratio is clearly more informative than the progress of the assets alone: the ratio, being dependent on price, is more responsive than the slowly changing asset index.

76. The other three factors, the cash flow, the stock level and the capital expenditure can also with advantage be calculated as a percentage of the price, thus giving a convenient standard for comparison between different companies and between the different industries. To demonstrate this scheme in practice the authors have been permitted to reproduce some interesting experimental calculations made by the Airways Investment Department, using the computer to analyse the accounts of the 600 shares covered by their index. In November 1963 the total valuation of the 600

shares was £13,525 million, about half the total valuation of all quoted equities. For these 600 companies the following factors were obtained.

	Percentage of total market valuation of 600 equities
Gross cash flow i.e. Net earnings for equities + depreciation	8·0%
Dividends (gross)	3·97%
Net dividends	2·48%
Net cash flow	5·52%
Assets for equity	61·0%
Net equity earnings	4·4%
Stocks	28·3%
1962/3 capital expenditure	6·7%
Net earnings on capital employed	$\frac{4{\cdot}4}{61{\cdot}0} = 7{\cdot}2\%$

77. This investigation shows that over the year 1962/3 for an important comprehensive sample of U.K. industry the net cash flow of 5·5% was distinctly less than the capital expenditure of 6·7%. For 1963/4 the capital expenditure is likely to increase from the relatively low level that obtained in 1962/3 whilst the stock item, which is some five times the cash flow, may readily rise by some 10% to 20% with increasing production. Hence it is not unlikely that U.K. industry will make considerable demands on the national economy for finance, either by way of increased bank advances or by stock or share issues. Similar investigations carried out for the various industrial groups may well have equally interesting economic, social and market implications.

PART V. INVESTMENT ANALYSIS BY COMPUTER

78. This is a fascinating subject which should in due course form the subject of a major contribution to the literature of the profession. Whilst any lengthy discussion on this theme is at present inappropriate, it is nevertheless important to draw the attention of readers to the invaluable facilities that the electronically computed index with its mass of stored investment statistics offers towards the solution of this problem.

79. First it is necessary to clear up some misunderstandings about investment analysis. On this subject there are two conflicting schools of thought. One group of analysts pays considerable attention to the past performance of companies, translating previous results into trends which are projected forward, thus attempting to forecast future progress. The other school maintains that past performance is largely irrelevant and bases their assessment on 'visits to the plant', interviews with the chairman, market research analysis and a close study of economic trends affecting the company. The authors believe that the proper technique involves a study of

both methods and a combination of their results. Sometimes one system is appropriate, sometimes the other, sometimes both.

80. In his paper entitled 'Higgledy Piggledy Growth' Mr I. M. D. Little of Nuffield College, Oxford, maintained that there was, if anything, only a negative correlation between the past performance of a company and the future growth of its profits. There is, in fact, some economic justification for this theme as exceptionaly favourable growth of a single company is often terminated by the increase of competition that this very success ensures. Conversely, poor results may improve as competitors drop out of an apparently unprofitable market. Hence a favourable or unfavourable trend carries within itself the seeds of its destruction.

81. These economic generalizations should not, however, be applied on too wide a front. Some trades admittedly are so competitive that results of companies engaged in them naturally fluctuate from year to year, past performance being thoroughly irrelevant to the future. In other trades, however, results are governed by reliable trends based on:

(a) long-term contracts
(b) loyalty of customers to well-known brands.
(c) a carefully selected trade concentrated on the more profitable portion of the market.

82. Finally the most important factors affecting results are those due to a management of above or below average ability. Altogether, there are many trends, which can be revealed by investment analysis and which are likely to continue, provided there has been no change in the conditions that produced them. This subject of past trends and their relevance to the future has been discussed in a recent paper by G. T. Pepper (*J.I.A.* **90,** 63). Here Pepper classified the trends in gilt-edged price ratios between pairs of stocks into those that are

(a) permanent, being caused by definite features of the stocks
(b) movements due to changing interest rates, etc., which may be reversed
(c) fluctuations.

Surely the same principles apply to ordinary share analysis. The same three groups of trends can be distinguished. Those that are likely to continue, those that may reverse and those that are due to short-term fluctuations in industrial profitability. The skill of the analyst lies in distinguishing between these three types of trends and making the correct interpretation from them as to the future progress of the share.

83. So far, the discussion has been confined to the relation between past results and future profit progress. An even more important factor is the relation between past results and the present yield basis of the company concerned. Whatever its impact on future progress, past performance is an essential factor in the market valuation of a share. Usually a company, with an above average past record of steady growth will be highly rated by

investors, and will carry a below average yield; with a poor past record, the converse applies. Altogether the analyst's task is to:

(a) study the past record
(b) distinguish between conflicting trends
(c) decide whether a trend that is likely to continue has or has not been fully discounted in the present yield basis.

84. The computer, fed daily with the statistics for the index, could in due course build up a history of price, dividend and earnings 'relatives' which would be a useful guide to the past record of individual companies (item (a) above). At the same time it could produce weighted means of these factors for the groups and for the whole index, thus setting up a standard with which these individual results could be compared.

The periodical display might be as follows:

Table 6

(A) Constituents and groups

	Constituent	'Relatives' to base date		
For every group:		Price	Dividend	Earnings
	1 2 3 :			
Weighted means for the group				

(B) Groups and the whole index

Group	'Group relatives' to base date		
	(1) Price	(2) Dividend	(3) Earnings
1 2 3 : 30			
Weighted mean of relatives for 500 share index			

85. The analyst could derive considerable value from ranking the constituents in order of their past performances and comparing this ranking with that obtained from the present dividend yield averages (taking the latter in the reverse order). The extent to which this past 'performance

ranking' differs from the yield ranking denotes the effect on the market of the current outlook for the share concerned and should be a valuable guide to special situations. At the same time, this technique might also be applied to a study of the performance of the group index, compared with the 500 share index.

86. A further clue may be obtained from examination of the 'yield ratings'. This factor for a constituent is the ratio of the present dividend yield to either:

(a) the dividend yield on the whole index
(b) the dividend yield on the group.

The traditional technique involves calculating weekly the ratings for each constituent, recording 'highs' and 'lows' of these factors. When after two or three years a sufficient history has been built up, the current rating is used as a guide to see whether the share is historically cheap or dear in terms of relative yield. Formerly, owing to the lack of satisfactory group indices, ratings were usually taken against the yield on an all securities index, usually the *Financial Times* 30 share index. For the new indices, ratings relative to the group yields would usually be the more valuable (except for miscellaneous classes where the overall average is probably more appropriate).

87. Important pioneer work, demonstrating how a computer can be used simultaneously for index calculations, and for analysis, has been done by J. G. Blease, B.Sc. (Econ.), the Investment Officer for the Joint Airways Pension Fund. The whole procedure is described in the *Investment Analyst* No. 1, November 1961. In the following paragraphs some figures, taken from the records of the 600 share Airways index, have been used to demonstrate how the technique described above is being applied in practice.

In the case of the Airways index, the weighted group averages of price, dividend and earnings relatives are the appropriate index figures based on the experience of all past constituents of the group rather than specially calculated means, using the relatives for present constituents. As this particular index used fixed weight principles, with changes restricted to 'casualties', this distinction is not usually of great importance. Where an important casualty has occurred (as in the Motor group following the Ford take-over), the proper figures can be readily calculated from the up-to-date relatives tabulated so conveniently each week.

88. For the whole 600 share index, the average dividend yield was 4·42. This figure, divided into the dividend yield of the constituent is the rating (item 6). High and low values of this factor are automatically produced by the computer, new extreme values being recorded as they occur. For the dividend yield ratings to the industry average, and for the earnings ratings the 'highs' and 'lows' have not been recorded by the computer, and need to be established by manual methods. With a consistent group like Breweries, ratings are best examined against the industry average (4·21)

With a less homogeneous group, however, the 600 share index is the more suitable standard.

89. The following examples from Table 7 show how the 'ratings' and 'relatives' are used for analysis. Constituent C shows sub-normal past growth: in recognition of this, the dividend yield is 5·08 against 4·21 for the group and the rating (industry) is 1·21. Conversely, D with an above average performance records a sub-normal yield and rating (3·7 and ·84). In both these cases, past results may well have been discounted in the present yield basis. On the other hand, constituent A with a rather better than average performance, has a high yield. The reasons for the discrepancy call for further investigation.

Table 7. *Brewery Shares at* 16.1.63.

Item	Constituent	A	B	C	D	Weighted group averages
1.	Price relative	1·241	1·180	1·001	1·946	1·180
2.	Div. relative	1·333	1·111	1·100	2·000	1·299
3.	Earnings relative	1·335	1·336	1·054	1·788	1·147
4.	Div. yield	4·38	3·90	5·08	3·71	4·21
5.	Earnings yield	7·60	7·30	8·90	8·60	7·40
	Dividend yield ratings to whole index					
6.	Now	·99	·88	1·15	·84	·95
7.	High since 1960	1·33	1·08	1·17	·90	1·00
8.	Low since 1960	·90	·73	·89	·61	·80
	Dividend yield ratings to brewery average					
9.	Now	1·04	·93	1·21	·88	—
	Earnings yield ratings to whole index					
10.	Now	·94	·90	1·10	·94	·91
	Earnings yield ratings to industry average					
11.		1·03	·99	1·20	1·16	—

Items (1) to (3) are based on a figure of 1·00 on 1 July 1960.

90. Three years is, in practice, too short a period to form a reliable guide to past performance. Rather than wait several years before using this material, it would be preferable to calculate manually the necessary 'relatives' from a suitable earlier base date to 1 July 1960 when the Airways index commenced. These relatives, once incorporated in the computer memory, would enable it to produce weekly the price, dividend and earnings relatives for 5 to 10 year periods.

91. A weekly display like this, with eleven statistics for each of 600 shares, suffers from the congenital defect of many computer projects, in that the output is so extensive that a large staff is needed for proper interpretation. There is much scope for research work here to devise methods of programming the computer so that it filters the output, concentrating its attention on those situations of particular interest to the analyst. The Airways scheme does, in fact, include a system of 'signals',

w reby all new 'highs' and 'lows' occurring each week are printed out on a special list. The computer can, of course, be programmed to draw attention to any other trends of features, such as for example a company whose rating (industry) has moved in the same direction for say six consecutive weeks.

92. So far, discussion has been confined to the traditional methods of investment analysis, methods which have been developed for manual computation. The authors believe that the time is not far off when more powerful methods of analysis will be employed. For example, the detailed technique of investment analysis described by Messrs. Weaver and Fowler in 'The Assessment of Industrial Ordinary Shares' (*J.I.A.* **86,** 243), may in due course be carried out by a powerful computer having sufficient storage capacity for the many details of past history that are needed. An alternative process particularly suited to the computer is that described by J. R. Hemsted in 'The expected yield of Ordinary shares' (*J.S.S.* **16,** 401). Hemsted showed that, given the ten-year history of assets per share and earnings on these assets, it was possible to deduce the likely growth rate of future profits. It must be emphasized that for any such methods of analysis the computer would merely perform the arithmetic and assemble the necessary facts. It would, of course, be left to the analyst to make a considered judgment of the future prospects based not only on these past records but on careful consideration of the latest information regarding the progress of the company concerned and of the corresponding trade or industry.

93. By using either of the methods indicated above it is possible to assess for a particular share the following factors:

r, the estimated growth rate of profits for the next few years
δr, the variability of this growth rate
d, the proportion of profits likely to be distributed as dividends.

With these factors available for a large number of shares a multiple correlation analysis may be undertaken relating these three factors to the price earnings ratio R, resulting in a regression equation of the form:

$$R = K + K_1 r - K_2 \delta r + K_3 d.$$

Having established this formula, based on say 100 to 150 shares, price earnings ratios can be readily calculated for a large number of companies and compared with the actual current figures, thus showing whether market prices of the shares concerned are cheap or dear in terms of analysed prices. Naturally in many cases an exceptional situation may be readily explained by special features such as a likely take-over deal, etc. Where, however, no such explanation can be found, any discrepancy between the market and the analysed prices will call for investigation and may disclose interesting investment propositions. The whole procedure is not greatly different in principle from the modern methods used for managing a gilt-edged port-

folio whereby the electronic procedures reveal the market anomalies for the analyst to study in detail. It is interesting to record that the technique described above is at present being used in the U.S.A. by the investment department of the Bank of New York. For fuller details reference should be made to the article entitled 'A New Tool for Investment Decision Making' by V. Whitbeck and M. Kisor, published in the *Financial Analysts Journal*, May–June, 1963.

CONCLUSIONS

94. The new index represents a very considerable advance over the earlier Actuaries and *Financial Times* series and should be widely used for checking portfolio performance and formulating investment policy. It also has considerable applications for long-term historical studies and for purposes of economic and social research.

95. With little additional effort the index coverage could readily be extended to include factors needed for investment analysis (asset values, cash flows, capital expenditure, earnings on assets, etc.) The authors believe that index treatment of these features of company results would be of considerable value to investment analysts.

96. The present index involves the assembling of an impressive volume of investment statistics, automatically maintained up to date each day. If the service were in fact extended to include the additional features mentioned above and if the resultant material were satisfactorily stored on magnetic tape, the investment statistics built up over a suitable period would provide all the raw material from which a detailed investment analysis by computer could be undertaken. The whole question of further developing the index coverage and making proper use of the index statistics is a most fruitful field for research by members of the profession.

APPENDIX

The constituents of the *Financial Times* index on 6.11.63.

	Price relative to that on 11.4.62.	Market valuation in £m
A.P.C.M.	1·227	138
London Brick	1·220	41
Turner & Newall	·890	119
I.C.I.	1·229	937
United Steel	·828	75
Tube Investments	1·014	114
Murex	·842	6
Swan Hunter	·867	12
Guest Keen	·974	187
Vickers	1·159	67
Herbert (A)	1·027	39
B.M.C.	1·053	154
Leyland	·995	83
G.E.C.	2·289	75
E.M.I.	·937	46
Hawker Siddeley	1·549	64
Rolls Royce	1·005	31
Lancs. Cotton	·946	18
Coats Paton	1·103	139
Courtaulds	1·742	289
Bowater	·977	87
Dunlop	1·105	97
Distillers	·922	413
Watney	·928	77
Woolworths	1·249	581
House of Fraser	·900	70
Imperial Tobacco	1·346	206
Spillers	1·319	71
Tate & Lyle	1·151	60
P. & O.	2·277	60
TOTAL	35·070	TOTAL £4,356

Arithmetic unweighted mean 35·070 ÷ 30 = 1·169
Arithmetic weighted mean 1·2038
Geometric unweighted mean 1·1246
Calculated index on 6.11.63 = Index on 11.4.62 (305·3)
× 1·1246 = 343·3
Index as published 6.11.63 = 343·8

ABSTRACT OF THE DISCUSSION

Mr H. W. Haycocks, in introducing the paper, said that he wished to repeat two of the points which he had mentioned at the meeting of the Faculty the week before. The first of those was that tribute should be paid to the *Financial Times*, and particularly to Mr Shillady, who was present as a guest. It was a significant event in the history of the profession that the Actuaries Index should be linked with the *Financial Times* which was, perhaps, the best-known financial paper in the world. Mr Shillady had borne the brunt of all the work done by the *Financial Times*. Relations with him had been extremely happy right from the moment when the project was first mooted. Indeed, he might well have become the third author of the paper.

His second point concerned something that was not dealt with in the paper. Had it been in the paper, the authors would not have been sure where to put it. The *Financial Times* and the National Cash Register Company were responsible for the day-to-day work. The Joint Committee felt, however, that they should keep some check on it. That was no reflection on the extremely accurate and valuable work being done by both the *Financial Times* and the National Cash Register Company but, as most people knew, human beings and machines were not infallible. Mr Sirkett had devised a useful method for calculating the adjusted base and for making a periodic check of the indices from time to time. It was not necessary to go into detail, but the fact that that work was being done should be recorded.

At times, the authors had wandered rather far from the subject of pure indices. Investment analysis was in its infancy. In Britain, it was still largely preoccupied with concepts, definitions and propaganda for obtaining accurate, appropriate and up-to-date information from companies and from investors. In fact, he expected the discussion to include a good deal of criticism of some of the concepts that the paper suggested.

Many of the methods of analysis suggested in the paper were only suggestions which required testing in practice. Investment techniques would always be a mixture of factual analysis, estimation—or, to use the more modern word, 'guesstimation'—and judgment, another very illusive word, which generally meant a mixture of common sense and experience. That applied, of course, to every practical subject, but the weights of the mixture varied from subject to subject.

Those comments applied particularly to correlation analysis such as that mentioned in § 93 of the paper and practised by the Bank of New York, the account of which given in the paper was much too brief. The authors had not seen a full statement of it before their paper went to print but since then, they had had a chance of seeing a couple of papers on the subject.

The price-earnings ratio was not the actual one—there would be serious objections to it if it were—at the price date, but it was what had been termed by the Bank of New York a 'normalized value', an expression which had caused him to smile. In their previous paper, the authors had used the word 'normalized' applied to a different concept—expected yield—and it had not gone down very well with the more practical-minded among the audience. However, the price-earnings ratio used by the Bank of New York was a little more concrete than the concept used by the authors at that time.

The normalized price-earnings ratio abstracted from the business cycle. The actual ratio tended to vary inversely with the cycle. If it was not 'normalized', it would be necessary to put into the equation a variable which in some way allowed for the stage of the cycle to which the earnings related. The tests made upon that technique had been quite impressive and suggested that it was worthy of development. It was not his place, however, to add to a somewhat lengthy and discursive paper. The use of correlation analysis as distinct from direct interviews was a subject which could well occupy a paper of its own.

Mr R. H. Pain, in opening the discussion, expressed the gratitude of the Institute for the continuing work of the authors on stock index numbers, the paper to be discussed being their second on that subject to the Institute in eight years.

With the introduction of the new *Financial Times*–Actuaries Index in the previous eighteen months, the detailed operations should be recorded officially by the Institute; and a paper read to members was the standard procedure. However, that did not necessarily, and the paper before them in particular did not, provide the best vehicle for recording the exact details of all aspects of the actual calculation of the Index. The great bulk of the detail provided no opportunity for discussion as it was mainly factual, and a note on procedures should still be given in the *Journal*. Some of the details were shown in a pamphlet 'A Guide to the *Financial Times*–Actuaries Index' which was obtainable from the *Financial Times*.

A great deal of detailed work had been done by the people concerned with the new index on a variety of subjects connected with it, such as a valuation of quoted securities for possible inclusion in the Index and an examination of many of those for classification purposes. That provided a valuable source of material to which other members of the profession might have access and which should certainly be preserved, as it would be needed by anybody reviewing the Index in later years. The work of classification had already resulted in the valuable side effect that the headings of the classification used for the *Financial Times*–Actuaries Index were becoming more widely accepted as a standard for recording purposes.

The paper began with a list of the uses to which the authors considered that an index should be put, presumably to imply that the new index was the best-designed index to suit all their purposes. It was doubtful, however, whether that was completely true and, later in the paper, when the authors referred to the problem of consistency between group indices and the overall index, it could be seen to be open to doubt. It was, in fact, not possible to design one index which would be the best for all purposes.

The comparison in Table 3 of the various indices in use during the short period for which the *Financial Times*–Actuaries Index had been calculated showed the quite wide differences that could emerge. The design of the index was highly important and could have a big effect on the result. Surely the main need for a large daily-calculated index was simply to record the average changes in the level of the stock market over long periods, with as little disturbance as possible to the supplementary calculations. It was for that main reason that an arithmetic rather than a geometric mean was chosen, weighting by current market capitalization rather than fixed weights, and that was why the lack of consistency between group indices and the overall index was accepted. On that basis, the all-share index provided the best indication of the movement in the market as a whole, and the group indices of the movements in the individual groups.

The lack of consistency extended, as the authors stated in § 23, within the groups, between the existing constituents and the group index. Where, for example, in the motor industry the very successful Ford Motor Company was taken over for cash at a high price, it could easily be that the group index would be higher than any of the price relatives for any of the remaining companies in the group. That did not in any way make the group index any less valid as a measure of the progress of investments in the motor industry over the period, but it did, possibly, affect the usefulness of the index for a comparison between the remaining companies in the industry at the end of the period.

It could be established quite readily that, between capital changes involving a change in the cash value, the movement of the group index was wholly consistent with the movement of the individual constituents, and in practice it would be very rare for a capital change to be of sufficient size to cause a large measure of inconsistency over short periods. That point led him to be slightly sceptical in judging the use of figures such as those in Table 1, where conclusions were drawn from the ratio of group indices to the all-share index.

Part III of the paper, dealing with the index in practice, followed very much from the

authors' previous paper, and the summary of chart theory went little further. The failure to forecast the market fall in 1961 proved no more than that the chartists were human.

On the section dealing with the progress of the different group indices, a chart of the progress of each group index was valuable in the same way as one of the overall index, in order to follow investment opinion. He was, however, doubtful about going the admittedly small step further and actually charting the ratios of the indices. The charts would indicate quite sufficiently the changing prominence given to different groups, and the need to select the over- or under-valued group could better be followed by charting the ratios of average dividend or earnings yields. As the authors stated, their ratio of the group index to the all-share index had to be assessed in order to distinguish between the changes due to alterations in payout percentages or market rating.

He felt that the lesson from Fig. 4 was not that the breakthrough in the ratio in mid-1962 would indicate the rightness of a purchase of electrical engineering shares. It was much more that the steady decline in the ratio between late 1961 and early 1962 would have drawn attention to the market reassessment and a study of the industry statistics and background would then have persuaded the analyst to take an interest in that sector where the brighter boys had already moved in. That put in question the whole basis of chartism and possibly meant no less than that the analyst should always deal better than the chartist would. His own feeling there was that chartism was very valuable in drawing attention to where the market assessment was changing but that the analyst should make up his own mind about the reasonableness of the change.

The new index, with its more complete series of group indices, enabled a better choice to be made in selecting the best index for individual purposes, such as for assessing portfolio performance and for approximate valuation. But the implication of the chain index had to be borne in mind: namely, that the index represented the institutional-type portfolio where, on the whole, rights and new issues were taken up in full. The authors neatly illustrated how much better an arithmetic index fared than a geometric one, and the new index would be that much more difficult to improve upon.

Long-term comparisons between share prices, earnings and dividends would become easier as the new index data built up. Adjustments for capital changes were made to the index as they occurred and were not allowed to accumulate as they did with a fixed weighted index. Thus, no major reconstructions were necessary at fixed intervals, with associated breaks in the earnings and dividend indices.

The index provided, of course, not an actual earnings and dividend index, but average earnings and dividend yields, though the former could be obtained by multiplying the yields by the price index. In that way, earnings and dividend indices were obtained that would have no break, unless the yields, following monetary changes, differed from the average group and all-share earnings and dividend yields immediately prior to those changes. Since most issues tended to have some bonus element, the dividend index would, on the whole, show some increases following a capital change, and because earnings on new money were assumed to be nil the earnings index would show a fall.

The uses for the fixed-interest indices were fairly obvious, though it was doubtful whether many people would go to the full lengths with the preference index indicated by the authors. The market in preference shares was narrow and the yield differences normally obtainable were well established. Certainly, the debenture index was of little use without the average yields which were suggested by the authors and which were, in fact, shortly to be introduced.

The authors were a little unkind to the Government 20-year yield. Obviously, a professional who assessed one Government stock against another would use the sophisticated methods which had recently been discussed in Staple Inn Hall; but a chart of the 20-year Government bond yield gave useful information about that market which, for many studies, would be all that was wanted.

The latter part of the paper, on future developments, was the more interesting. For

the index calculations, a large amount of data on prices, earnings and dividends was being fed into the computer and, at present, the bulk of that information was lost after each day's calculations as, for the purposes of the existing index, it was no longer required. It could, however, very easily be stored for subsequent analysis. Standard & Poors, in America, were, for instance, currently offering a service which amounted to the British Extel yellow card service in punched paper tape form ready for feeding into subscribers' computers.

Too much should not be made of the use of computers for the selection of equity investment. Computers were a 'natural' for the assessment of gilt-edged stocks—a limited amount of variable data upon which a large edifice of valuable calculations could be built. For equities, however, the amount of useful arithmetic that could be devised was limited and the amount of data and the difficulty of its exact definition and assembly were very great indeed.

The particular statistic of assets ÷ price, chosen by the authors for analysis in greater detail, appeared to be the least interesting of the average ratios listed from the Airways investment department's figures shown in § 76. Admittedly, it was a component of the earnings yield, but it was difficult to see how changes could be assessed. It was currently in use for assessing investment trusts and it might be of value throughout the financial group—for example, for insurance companies if any reliance could be put on the value of assets. The display of 'relatives' to the base date would be helpful, although a properly programmed yield rating service might be more so. That enabled a watch to be kept on all sections of the market—a difficult job manually—for the important clues to areas where the market's assessment of a stock or industry was changing, so that it could be examined by more conventional methods.

Since the work by Little, emphasis given to the assessment of the future prospects appropriate to every investment decision had tended to make any analysis derived from an examination of past data rather suspect, and the problem of choosing the best investment was no easier. Clearly, the future was the more important, albeit the more difficult to assess.

There was currently available a much wider range of statistics than before on trade and industry from which a better assessment might be made. What tended to happen, however, was that in choosing the best investment, a start was made with the most favourable industry, then the best area in that industry and the best management, and so a company was selected. But that had then to be related to the current share price and, almost inevitably, the chosen company would be yielding 1%, be one and a half times covered and have a desperate need for extra working capital. The statistics tended to be so well known that the market was almost always there first.

In fact, past data could not be ignored, for two reasons. First, the assessment of a company's future had to be put against its reflection in the share price; and secondly, the past data presented the only guide to how the market reacted to changing industrial and company news. It seemed that it was not necessarily wrong to start by looking at the past data provided by the index coverage. The approach likely to be most rewarding was to use the technique of charting price relatives or using yield ratings to see how the market had built up its assessment of different shares. That approach could then be judged against an assessment of the future prospects of the companies, and the investment decision would emerge where those two assessments did not coincide.

An immediate extension of the index to include either earnings or dividend ratings would certainly be worth while. It would be necessary to build into that, however, some selection procedure. The value of each share's rating—i.e. the ratio of its yield to that of its group average—by itself was of no use, nor to any extent was the high and low of the ratio. The time when a share's rating was of interest was when it changed to an extent deemed to be significant. It should certainly be possible to programme the computer to print out and highlight only those occasions, with some allowance for the market expectation of dividend changes before and over the actual dividend announcement.

That tended to be the difficult time with yield ratings, in that the market always had some expectation which was influencing the yield.

The next problem, of relating the assessment of future prospects to the current share price, had been covered by the work done by Weaver and Fowler and by Hemsted. The work by Whitbeck and Kisor, referred to in the paper, was also on similar lines, especially in relation to that by Hemsted, and would certainly repay greater study. It suggested a further use for the accumulated index data in that, at some date in the past, model portfolios could be selected on different criteria such as, for example, growth stocks, high cover, or high or low yield. Their progress could then be tested for portfolio performance in order to judge the usefulness of the criteria themselves. Certainly, the authors made a conclusive case for storing for further use a large portion of the data currently being processed with the new index.

Mr J. R. Hemsted said he was sure that the great benefits from the indices were still to come. If he might be allowed a little friendly criticism of the paper, he had rather expected to find it clearly stated what the formula was, instead of which it appeared to be rather wrapped up.

A basic formula was given in §15, but §19 stated that 'The above formula . . . is the same in form as that for the *Financial Times*–Actuaries Index'. He was not sure whether the form was quite the same. He had worked through the business of fixed weights and current weights, which admittedly was interesting, but even then it was not immediately clear whether the result was a compromise or a fixed or a current weighted formula. He thought, however, that it was a current weighted formula.

The description of having a portfolio which was sold at market price and the proceeds used to buy back a proportion of the new market was easy to understand. In consequence, it was a little confusing to turn to § 44, which did not seem to be quite consistent with the earlier description. Probably the index remained proportionate to the market values, which was what most people would expect. He did not, however, believe that it represented the experience of an institution which took up its rights.

There was no institution which sold all its portfolio and then bought a new one each time there was a new capital issue, but that was really a better description than the later one of raising the money to take up rights by selling equal fractions of all holdings. What happened, according to the index, was that the institution sold, and then bought back only a proportion of its new shares. Consequently, the index did not represent the passive institution.

The subject was one which had interested him for some time, because when working on that sort of problem he had come to the conclusion that he did not really like the market value adjustment at times of rights issues for the purpose of adjusting the record of dividends and earnings. He did not like it because it brought in the variable of the market value, which was quite arbitrary, and had no direct bearing on the progress of the company itself or the dividends. It was better to use an asset value adjustment, and that, of course, was independent of the conditions at the time the rights issue was made.

Had the Committee considered using an asset value adjustment in their formula instead of the market value? It would have made it slightly more complicated for the computer, but it should be able to handle it satisfactorily. There would have been the advantage that, when trying to produce some sort of profitability index or even a growth in asset value index, there would not have been the distortions that were liable to arise with the present index. Admittedly, such a distortion would be small in view of the size of the index, but the point was theoretically interesting.

To check performance against an index should be a great incentive towards efficiency and, possibly, a little more could have been said about that in the paper. The paper by Gilliland suggested only a quarterly test. Probably, with computers coming more and more into use, more frequent tests would be needed, and it was not very difficult to work out a system for making a hypothetical index purchase at the same time as making

each actual purchase and thus building up an index portfolio to watch and compare with the actual investments. It would be necessary to make valuations of the actual investments to test performance, but the index portfolio would be available at any time it was needed for a quick estimate of current value.

Mr B. H. Fison's first comment on the paper concerned portfolio performance. He and his colleagues had found the index, and its division into the various industrial categories and groups, of considerable assistance, and techniques had been, and were being, developed all the time. One small detail, however, of the matter of testing portfolio performance brought into sharp relief the effect of using a weighted index.

During the period from the end of September, 1962, to about the end of September, 1963, he had been concerned with a particular portfolio where the financial group had, as would be expected, taken quite a battering over that period. More than that, however, for no reason which came to light on a superficial examination, the finance section of the portfolio seemed to have slipped rather behind the index of the financial group. Further detailed investigation brought the matter down to a consideration of the composite insurance section.

Again, as was generally known, and particularly in the Institute, that group had not been faring too well in the markets, but it was somewhat surprising to find that that relatively small part of the portfolio had fallen by something like 16%, whereas the composite insurance group index had dropped by only 6·5%. On normal investment criteria, that would seem to be a remarkably large difference. In the end, therefore, it was necessary to investigate the progress of each company within the index and in the portfolio.

It turned out that the portfolio did not hold the shares of the largest single unit in the group, and that over the period not only had the shares of that particular company not fallen, but they had actually risen by 6·5%. Thus, although the bulk of the shares in the index group, which might be regarded as the field for possible investment, had suffered falls ranging between 10% and 20%, it happened that the one which had a positive gain over the period was the largest one, thus pulling the actual sub-group index well out of line with what the majority of companies' shares had actually suffered.

In § 61 of the paper, there was a reference to the preference index and the use of preference yields in carrying out a policy of switching between preference stocks and long-dated gilt-edged stocks. Whilst it was true that in certain circumstances that could be a practical proposition, more emphasis might have been placed in the paper on the fact that a study of such yield ratios as were set out in Table 5 would be of great use in taking policy decisions as to timing the running down of any preference portfolio or, on the other hand, building it up at a time when yields were above average.

A practical point that was not made in the paper was that the yield ratio between preference yields and yields on undated British Government stocks appeared to be a function of the rate of change of the yield obtainable on the undated Government stocks rather than a function of its absolute level. Although the use in the table of figures at three-monthly intervals could be somewhat misleading in that what appeared to be a rise over a period could hide an even sharper rise followed by a fall, so that the actual direction of change at the time the figures in Table 5 were struck might differ from the three months' change, nevertheless it was interesting that the time when the largest increase in the Treasury 2½% yield occurred—from March to June 1961, when it rose from 6·15% to 6·55%—showed the lowest yield ratio of the period. Conversely, a few lines lower in the table, in September 1962, the yield on Treasury 2½% had dropped quite sharply from 6·30% to 5·61% and the yield ratio had sprung apart to 1·25. That followed naturally from the fact that the preference share market was less volatile than the gilt-edged market.

In § 55 the authors commented on the possible applications of indices of earnings and dividends to economic surveys. He heartily endorsed the need for clear thinking

in that section and it would be most useful if further surveys were made indicating the progress both of profits related to the assets and the capital employed in businesses and also, as was mentioned by the authors, the dividends receivable by a shareholder who did not inject fresh capital into his investment. Both political parties could usefully be advised to consider the matter more carefully when making comparisons between profits, dividends and wages.

In § 80 the authors used a phrase with which he had some sympathy when they remarked that 'a favourable or unfavourable trend carries within itself the seeds of its destruction'. When considering growth shares and the possibility that past high rates of growth could be maintained, it was essential to consider the forces of competition.

The behaviour of shares in the market to some extent followed a cyclical pattern in that the previous day's favourites could be the next day's dead wood. That was brought sharply into focus by a comparison which he had seen of eleven local authority superannuation funds, both large and small. Two comparisons had been carried out in the eighteen months of index figures available, the first covering twelve months and the second covering the following six months. The sharp turnabout in the fortunes of the various funds was most interesting to observe.

In the first twelve month period, the range of performances related to the index went from +4·9, which was the best achieved in the twelve months, to −11·3; and in the second period, which was only six months, the range was from −1·9 to +1·9. The most interesting feature, however, in the context of cyclical fortunes of shares was that each fund which had out-performed the index in the first period not only did less well in the second period, but actually fell behind. That was broadly what might have been expected, but it was quite surprising to find that, of the four or five which had beaten the index over the twelve months, every one fell behind in the following six months. On the other hand, each one which had dropped behind in the first period later did better. It could not be pretended that they were all saved by some miraculous cure and all beat the index; one or two of them had done so slightly and one or two had fallen behind, but by much smaller amounts than had obtained in the preceding twelve month period.

It was interesting to see the reference towards the end of the paper to the multiple correlation analyses, to which Mr Haycocks had referred in his opening remarks. Work had been done on those lines by his own colleagues. Where they would place a slightly different emphasis from that of the authors was that the latter were, perhaps, unduly influenced by Mr Little's thoughts on 'Higgledy Piggledy Growth', and he had noted that the three factors that were set out in § 93 all referred to the future: i.e. the estimated growth rate of profits for the ensuing few years, the variability of that growth rate and the proportion of profits likely to be distributed as dividends. Granted that in the derivation of some of those factors historical material had played a part, nevertheless it was possible to extend the list of factors on which the multiple correlation analysis was carried out to bring in some current market features and some strictly historical data.

The investigations carried out by his colleagues had shown, for example, that the current payout rate—i.e. the proportion currently being paid out as dividends rather than a future estimate—appeared to account for one-quarter of the ranking of shares in the market, which was an extremely high percentage to put upon one figure. On the other hand, there was a purely historical figure relating to whether or not earnings had fallen sharply in any one year in the past and that, again, appeared to play a quite significant part in the market's ranking of the shares.

One or two illustrations of the results achieved by the investigations—some figures as at November 1963—confirmed most interestingly that the market appeared to over-discount future growth in the low yielders and to under-discount the prospects of recovery in high yielders, which was a universally observed phenomenon. There were only three companies in the investigation which gave current returns below 2%. Wimpey appeared to be giving only 59% of the yield that it should, Jaguar 60% and Pasolds 54%. On the side of the high yielders, Hawker Siddeley appeared to give half as much

income again as it should, Associated British Pictures nearly 50% more and Lancashire Cotton 113·9% of the 'correct' yield. All these investigations were of interest. They tied in with the index data and the various calculations surrounding it.

As a closing plea for the future, he would like a really definitive statistical investigation into the behaviour of high and low yielding shares to be carried out so that their relative merits ceased to be a matter for debate and could be established. It could be done by getting the computer at, say, three monthly intervals to rank the component shares according to current yield related at the time to the index yield and following them for, say, twelve months, two or three years, or until one business cycle had been followed. In that way, much useful data could be provided.

Mr K. Sandom said that the paper discussed the use and scope of a new actuarial weapon. The range of its uses was so wide that it might be likened to a new battery of arms, rather than a single weapon, to be used in the war against future uncertainties. Although its value was well demonstrated, however, the authors would be the first to agree that the suggestions given in the paper did not exhaust the possible uses.

In particular, as had been mentioned by previous speakers, the section on portfolio performance deserved more attention. It suggested that the index, with or without oil shares, might be used as a model portfolio; but like the 'model office' of former days, the 'model portfolio' had limited use. That was illustrated by the diverging results for the various indices given in §§ 52–3. Everything seemed to vary according to the constituents. It was necessary to examine the figures carefully even where the results were in close proximity.

The main power of the index appeared to lie in its grouping by trades in homogeneous sections. Institutional portfolios could be grouped relatively easily in comparable sectors, and the price and dividend performance of such groups could be compared with the sub-groups from the *Financial Times*–Actuaries Index. That should indicate the performance of the particular 'mix' of shares selected by the institution.

The constituents of the sub-groups were weighted by market capitalization, which gave a fair reflection of the industries' performance. Institutional holdings, however, selected over a period of years, increased by spurious rights issues and take-overs, could give surprisingly different results. An analysis in those sub-groups could resemble an 'analysis of surplus' of assets with the experience for the index sub-groups as the 'expected'.

Grouping could be quite simple with the aid of a computer or punched card equipment. Some shares were difficult to classify, but the majority of such shares, like Metal Industries, British Ropes, English China Clays, Distillers, Unilever and Beechams, could be included in the various miscellaneous categories of the industrial groups. For such an analysis, new purchases and sales and their dividends would have to be excluded, with adjustments for rights and capitalization issues. Indeed, a separate analysis of the performance of new purchases could be quite illuminating to investment managers, perhaps to their Board and certainly to their stockbrokers. In that way, a comparison of portfolio performance would be replaced by a series of analyses of investment policy. Certainly, it would hardly hinder investment policy.

In view of current political controversies regarding profits, wages and prices, the statement in § 51 of the paper deserved comment. The authors inferred that share prices had outpaced retail prices and wages since 1930. That might be true, but it was a little misleading. Weekly wage packets were a much better statistic than wages; they included overtime pay, whilst wages were fixed rates. Relevant post-war figures in order of growth indicated that weekly wage packets had outrun retail prices, which in turn had beaten share prices, which had outstripped equity earnings.

Part IV of the paper dealt with combined figures from company accounts. Differing asset valuations, accounting practice, depreciation, investment allowances, taxation, takeovers, rights issues, and so on, distorted such collations. Indeed, the authors referred

to such distortions in § 55 when they mentioned the quarterly publication of combined accounting figures in the *Economist* and the *Financial Times*. Ratios of combined accounting figures seemed to have restricted value, unlike market prices, earnings and dividends; the latter were not strictly company statistics, but rather shareholder statistics or 'investment statistics'. Indeed, as the paper was likely to become part of the syllabus for the examinations, he hoped that Part IV would be made optional reading.

There were many uses of the current data for the index preferable to extending the facilities to accounting figures; they were quite well covered for individual companies by Exchange Telegraph, among others. It seemed desirable to exercise great care in establishing fruitful fields for investment analysis by computer. The authors rightly referred to the 'congenital defects of many computer projects'. It was expensive to maintain an extensive staff for proper interpretation. It seemed desirable that an Institute committee should be formed soon to study ways and means of deploying current information more fully since it was far easier to programme data for retention as it was being collected than to attempt to do the job ten years too late.

Other speakers, particularly Mr Fison, had mentioned one field for useful research, and a few comments might be added on comparisons of stocks offering high and low dividend yields. In § 85, the authors referred to that aspect, mentioning the possible field for research, ranking companies by past performance and by present dividend yield. A year earlier, by way of a pilot survey, he had himself prepared a few trial calculations based on the former Actuaries index which had a consistent base for five years between December 1957 and December 1962. His survey seemed to indicate that industrial groups offering low dividend yields did not necessarily show either (*a*) superior performance in price or (*b*) superior performance in dividend growth. The market tended to be consistent, however, in its assessment of status as indicated by dividend yield. Stocks offering high initial dividend yields showed the highest cumulative income over the five-year period, which was to be expected. Indeed, it seemed significant that high-yielding stocks were the only groups that came up to expectations. Available data were restricted, but a survey on those lines for the vast volume of new data could be most instructive in fashioning investment policy and perhaps market psychology.

Mr J. B. H. Pegler said that some of the remarks of earlier speakers had provoked him into making some brief observations. He had tremendous respect for the authors of the paper, who combined a wide technical knowledge with a very sound grasp of investment principles and practice. They had presented a first-class paper. It was, however, in danger of being misunderstood and, perhaps, leading people in the wrong directon. He wished to mention one or two instances.

There had been some talk about portfolio performance and beating the index, which, presumably, meant finding out whether the market values of one's shares had risen more than the index over the period since purchase. That criterion was of some importance because anyone who had 'beaten the index' knew that he had bought his shares cheaper than the average. It would be a pity, however, to be led into thinking that that was the only criterion of success in investment, or even the most important criterion, in the case of the great majority of funds with which actuaries were associated.

When he had first read the section of the paper which referred to charts, he had shuddered because that word conjured up memories of beautiful diagrams he had seen in the past which were undoubtedly works of art but which, in fact, were utterly useless for practical investment. He need not have worried, however, because the authors of the paper before them knew perfectly well what they were talking about and he had no quarrel whatever with their treatment of the subject. There was, however, a danger that some people might feel that encouragement was being given to the worst aspects of chartism, and he was somewhat concerned at the remarks of, for instance, Mr Sandom. The statement that the paper provided a whole battery of armament in the war against uncertainty might well be interpreted in some quarters as meaning more than he

believed Mr Sandom intended it to mean. In much of their work actuaries relied very largely upon what had happened in the past to guide them in the future, but they should avoid letting other people think—and, indeed, thinking themselves—that past performance of market values in the investment world would help greatly in the war against uncertainty in forecasting future movements.

Mr Fison had referred to the high and low yielders and suggested that an investigation could be undertaken to resolve the problem: in other words, if he had understood him correctly, the problem of whether high and low yielders were 'better buys' than those in the middle range. When that subject arose during discussion of the authors' previous paper, he had himself suggested some reasons why those were best buys, and apparently they were still thought to be so. He doubted, however, whether it was really worth while to investigate the subject very thoroughly. There had already been a reference to certain items containing the seeds of their own decay. Did not that too contain the seeds of its own decay? If it were to be established as an incontrovertible fact that those high and low yielders were the best buys, the likelihood was that people would buy them more and, therefore, they would cease to be relatively cheap.

Mr L. G. Hall said that the authors' work provided a notable example of co-operation in a project of national importance in the financial field between actuaries and a non-actuarial group, the expert staff of the *Financial Times*. It was vital that co-operation of that kind between actuaries and non-actuaries should continue and increase. Actuaries had a great deal to contribute in the fields of business finance and investment analysis and there were still too few people outside the profession who realized it.

There had been much discussion recently on the subject of discounted cash flow. A textbook entitled *The Finance and Analysis of Capital Projects* had been written by A. J. Merrett and Allen Sykes, and a paper entitled *Discounted Cash Flow: the Proper Assessment of Investment Projects* had been written by A. M. Alfred for *The Investment Analyst*. Mr Alfred, who was primarily concerned with capital investment by a company but who pointed out that the same considerations applied to the portfolio investor, suggested that the objective which a company sought in its investment policy should be the maximum discounted net cash flow—i.e. after taxation but before depreciation—considered over the lifetime of the assets bought. Translated into actuarial language, that was no more and no less than the yield. Mr. Alfred had gone on to express the somewhat startling view that lack of awareness of the true economics of intensive investment was largely responsible for the slow rate of modernization of British industry. It should not be thought that he was being in any way critical of Mr Alfred's work—quite the reverse—but he was concerned to point out that he could find no evidence of any direct contribution by actuaries in the recent development and elaboration of techniques which rested squarely on the theory of compound interest. At a meeting at which Mr Alfred's paper was discussed, two Fellows of the Institute of Actuaries, including one of the authors of the paper under discussion, had pointed out the contribution which actuaries could make.

In the last part of their paper, entitled 'Further Developments', the authors had dealt briefly with a number of factors besides the ubiquitous dividend yield and earnings yield which were relevant to investment analysis. But did not all those factors distil into the very simple conception, which was as old as the hills, of the estimating of net cash flow year by year and the discounting of it by the net yield factor? He did not want to confuse the portfolio investor and the industrialist who proposed to buy up a new subsidiary. The real cash flowing to the portfolio investor was, of course, the net dividend and any appreciation in market value which might come before he sold; but everyone knew that what really counted was what lay behind and supported the dividend and the capital growth.

The great importance of initial and investment allowances at their current high levels, and indeed their variation, not only from industry to industry, but even with geographi-

cal location, and the consequent major fluctuations of cash flow, made the discounted cash fl w approach the only proper one, and it had to form the basis for judgment. It was not enough to use even price/cash-flow ratios without a good idea of how cash flow was likely to vary with time. The trouble from the investor's point of view was, as always, the difficulty of getting enough information and making sufficiently accurate forecasts to make the use of sophisticated techniques possible and effective.

There was need for actuaries working in the finance and investment field to go outside the confines of the Institute and make their abilities known. It was unfortunate that the Chairman of the Society of Investment Analysts was prevented by illness from being there. That Society was a body which numbered many actuaries among its members and in which actuaries played a full part. Indeed, three of them served on its Council, and it would welcome an even stronger contribution to its work by the actuarial profession.

Mr J. G. Day said that the *Financial Times*–Actuaries Index was a splendid achievement involving a lot of work, but he was worried, as a user, about the group indices. Some groups were homogeneous—insurance companies kept to insurance and discount houses kept to discount business—but many others were quite heterogeneous; and since the groups were formed, the situation had become worse.

As examples in the original list, Royal Worcester was ascribed to the 'Household Goods' group; its main business had, however, become the production of electrical resistors for industry. In the Textile group, Bleachers Association had announced that it was changing its name to Whitecroft Industrial Holdings as it was 56% non-textile. Such examples showed that many of the groups were not homogeneous. As far as was known, no information was given to the public about changes, so that the public did not know what was currently in the various groups, nor was it easy to find out. For the user, therefore, the groups were potentially dangerous; it was difficult to find out what was in them and, certainly, many of them were not homogeneous.

Another big point was that many companies did not keep to their original business and were spreading between industries and between consumer goods and capital goods. Many of the companies included in those sections had since spread from one to the other. Considering the causes of capital changes and the reasons for a constituent being removed from a group, it seemed unlikely that the selection of companies which raised capital or which were removed were random. Any comparison, therefore, of earnings yields over a period was probably being affected by a feature which was not random.

His plea was to ask first for regular information of what was done for the index and, secondly, whether it was not possible to have more pure groups. Certainly, some groups were fairly homogeneous, but it would be a pity to mislead people into thinking that all groups were homogeneous. Homogeneous groups were needed and then large miscellaneous groups to make up the total index. In any event, it was doubtful whether the yields and earnings yields were comparable. As Mr Weaver had pointed out, the earnings yield in the motor industry went up overnight from 2·8% to 5·1% when the British Motor Corporation results were made known.

The further works suggested in Part V of the paper were very welcome. He himself belonged to the school which thought that those were purely yardsticks. The paper would provide another set of yardsticks, which would be splendid, but it was rather like having another set of papers to hand to someone else to read.

Mr J. K. Scholey said that he had been induced to speak by Mr Pegler's closing remarks concerning high and low yielders. It had to be realized that they were not talking, in market values, of true values of particular objects. They were talking about the prices at which bargains were struck as between buyers and sellers; and when talking about striking bargains, they were obviously talking about the inter-relation of human beings and their hopes and fears. It would be a useful concept to consider the changes of high and low yielders as against each other as showing how expectations had or had not been

justified. He therefore supported the plea by Mr Sandom and Mr Fison for a subdivision of the indices to show the actual performance of high yielders, low yielders and the rump in the middle over periods of, say, one year, two years and three years.

Mr A. L. W. Shillady (a visitor), who expressed his thanks at being invited as the representative of the *Financial Times* to hear the erudite discussion on a most interesting paper, said that the authors were to be congratulated. It hardly had to be said that the new series of indices was a great success. There was fierce interest in every detail of them. Inquiries were received from all over the world and they were reproduced wholesale in other journals. To date, 5000 copies of the guide to the indices had been sold, which was very good going for a rather technical and dry subject. The *Financial Times* greatly welcomed the association with the two bodies of actuaries and hoped that the Institute was deriving equal kudos from the joint venture.

On the subject of the paper, there was not much of value that he could add to the discussion. He was not an actuary but was merely a financial journalist to whom had been delegated the job of looking after the *Financial Times* indices. He was, in fact, a little afraid of the enthusiasm of the authors for index numbers.

He recalled that the late Hargreaves Parkinson, Editor of the *Financial News* and authority on share index numbers, used to say that one should not hang a man on the evidence of an index number. He (Mr Shillady) was not sure that the authors would not. He could not see the trade unions being impressed with any index numbers whatever except those related to the supply and demand for labour.

He wished to make some references to the *Financial Times* 30 share industrial ordinary index, because anybody reading the paper might get it a little out of context, or, at least, what he thought was its context. The authors had expressed surprise at the coincidence of the *Financial Times* 30 share index with the *Financial Times*–Actuaries 500 share index minus oils on a single date, but he would be surprised if the two indices ever parted company to any material extent. There was a good reason for that. It was the 500 number that mesmerized people. They might, however, be inclined to overlook that it was the weighting that mattered.

The Stock Exchange had published a list of its biggest companies by market valuation as at March 1963. The top 60 of them accounted for 60% or more of the market valuation of all the shares in the 500 share index minus oils. Thus it seemed fair to say that it was those big 60 constituents which wagged the adjusted 500. The bulk of the 30 were included in the 60. If such a rate of sample were used in a Gallup poll, there would be no need to hold a general election. The right result would be known.

The point at which weighting became significant in an index was a matter for speculation, but many of the batches in the 60 had similar weights. The authors had compared the 500 share index minus oils with the *Financial Times* 30 share index at a single date. As the Institute and its members might like to see the comparison for the whole 23 months of the existence of the *Financial Times*–Actuaries indices, the *Financial Times* was publishing the following day a chart showing, on the same scale, the *Financial Times*–Actuaries 500 share index minus oils and the *Financial Times* 30 share index since 10 April 1962, which was the starting date of the *Financial Times*–Actuaries Index. The similarity throughout, in slump and in boom, was marked.

The two indices developed temporary differences, particularly when markets were moving sharply up or down. In a falling market, the 30 share index fell first and furthest; in a rising market, it rose furthest and fastest. In most months, however, the two indices came together again, despite what had gone before. Perhaps that behaviour was to be expected when one index was composed predominantly of leaders in their own fields and the others were leaders plus active secondary issues.

On the subject of the geometric method of calculation, it should be noted that the 30 share index had never been put forward as anything more than a price index. It was a daily newspaper index intended to show what appeared to be happening to prices in

the industrial market currently. It did it with reasonable accuracy three times a day, and more frequently on crisis days. The day-to-day bias because of the method of calculation was slight. The authors of the paper seemed to prove that the *Financial Times* was right to use it, and so did the performance of the *Financial Times*–Actuaries 500 share index. Perhaps weighting and/or the inclusion of secondary stocks produced much the same downward bias on the 60 as geometrical calculation did on the 30. That, however, was something that actuaries were better qualified than he to know. At any rate, so far the answer had been the same.

In connexion with economic planning, the authors had suggested producing at, say, monthly intervals an adjusted index without oil shares. That was already done in the *Financial Times* office each day, so that the *Financial Times* 30 share index, which was solely industrial, could be checked against the industrial contour of the 500 share index.

There was a reason why the *Financial Times* adhered rigidly to industrials for the 30 share index. On investment policy, it was reckoned that it was the climate of investment opinion on home industrial prospects that mattered most, so the 30 share index excluded oils, which operated mainly overseas, and finance and property shares. For his own part, he would like to see oils permanently elsewhere in the *Financial Times*–Actuaries Index than in the 500. Until that happened, anyone who wanted a *Financial Times*–Actuaries home industrial index had to do some recalculating.

Mr H. G. Clarke, in closing the discussion, welcomed the presentation of the paper to the Institute as providing an opportunity for members – and, indeed, for visitors also— to express their views on the method of construction of the index, its usefulness in various directions and whether they had any suggestions to offer for its improvement or extension. In endeavouring to sum up the discussion, he proposed to try to keep the matter under those three different headings.

Surprisingly few people had spoken about the method of construction. Only the opener and Mr Hemsted had referred to the fact that the indices were based on arithmetic means and that the weights were proportionate to market capitalization. Mr Hemsted had indeed queried the method by which the index dealt with capital changes, but broadly it could be taken that there was general approbation for the method on which the index was based. He was himself particularly impressed by the authors' statement in § 14 that there were a number of other important indices throughout the world which were calculated in the same way as the *Financial Times*–Actuaries Index. There could be many ways of calculating an index, and some ways were better for some uses and some were better for others, but one of the most important things was to be able to compare a British index with indices for other countries. It was, therefore, extremely comforting to read that comment in the paper. The authors did not, however, say whether, in those other countries, capital changes were dealt with in the same way as was done in the *Financial Times*–Actuaries Index.

Not only was the Institute pleased to see Mr Shillady, but members had been most interested to hear what he had said. In one way, after saying how pleased he and the *Financial Times* were to be associated with the Institute in the new *Financial Times*–Actuaries Index, he had proceeded to suggest that the old 30 share index was just as good. There was a good deal of substance in that suggestion but it drew attention to the fact that the really important step forward with the 594 share index was that it was of such a size that it could be divided up into viable groups, whereas Mr Shillady would agree that the 30 share index could not be so divided.

It was surprising also how few of the different uses for the index had been referred to. Most people, however, had referred to the question of portfolio performance, and he wished to say something on that, but first he wished to refer to another point.

In § 32 of the paper, the authors noted that the turning point of dividends usually came before the turning point in earnings, 'and', they added, 'often before the corresponding moves in the share index itself'. He was by no means sure whether they had any

justification for making that further statement. A link could be seen between the points of time at which dividends and earnings might move, namely that dividends could move a little earlier than earnings, but a further link with price movements could not be seen. It depended entirely on whether investors could foresee the coming increases of dividends and earnings and, therefore, put the prices up first or whether they did not see them until afterwards and, therefore, put the prices up afterwards. In Fig. 3, the authors did not, unfortunately, show the prices index but it could be seen from the record of the *Financial Times* Industrial Ordinary Index shown in Figs. 2 and 3 that in the early part of 1963 the rise in prices occurred before either the rise in dividends or the rise in earnings.

Returning to the question of portfolio performance, he was very much in sympathy with Mr Pegler's view that in some ways the idea of checking on portfolio performance could be rather frightening, particularly to the investment manager, who obviously would be the target for those checks. They would have to be carried out over a considerable number of years before it could be certain that they were valid. It could happen for a firm to sack its investment manager after carrying out checks for only two or three years, and then discover six months later that he was right after all.

In the same context, there had been some reference to providing a means of checking the relative experience of low yielding equities and high yielding equities, and a period of three to five years had been mentioned. There again, although a period of three to five years sounded quite a long time, in the investment world it could be quite short and did not conclusively prove what the ultimate outcome of an investment policy would be, although it might indicate that its timing could have been better.

It was in the fields of historical studies, economic surveys, approximate valuations, and so on, that the index really came into its own. The fact that there had not been any comments in that direction was, perhaps, explainable by the very obviousness of its usefulness in those areas.

The opener had given a very good summary of how he would use the index for selecting investments. In other words, he had pointed out one of the main uses of the index in that it could direct attention to the shares of areas which could repay further investigation. When, however, it had been decided what to investigate, an investment decision was then reached by more conventional methods.

As regards the improvement and extension of the index, the opener had queried the value of the authors' suggested refinements on preference shares and that was a view which he himself shared. As regards debentures and loan stocks, the authors suggested that the index might be improved if an average redemption yield could be given. He thought members would be interested to know that if all went well between the *Financial Times* and the National Cash Register Company, it should be possible shortly to provide such a yield for a 20 year debenture and loan stock.

He was rather surprised to find that in § 65, in reference to redemption yields and the use of such an index, the authors stated that 'for the majority of debentures jobbers quote 5 or 10 point prices'. He had been given to understand that the jobbers' prices, at least for the fifteen stocks included in the *Financial Times*–Actuaries Index, ranged from $\frac{1}{2}$ to 1 point margin. Obviously he would be concerned about the validity of the index if they were, in fact, quoted with ranges of 5 or 10 points. That, however, did not appear to be the case.

On the question of Government stocks, he agreed with the opener who was rather critical of the authors' remarks as to the somewhat elementary form of the indices that were presented. As a simple investment manager, he thought that there was merit in being provided each day with a few elementary but basic factors such as Government yields, debenture yields, etc. Those were, after all, the points from which to start to consider the merits of any investment in the whole range of investments available, because they had always to consider from the outset what could be obtained without risk in Government securities. Some of those simple factors were well worth recording.

All actuaries would agree that their professional experience qualified them in some measure to give advice and guidance as to the collection and presentation of statistical material generally and that there was no reason why they should feel other than so qualified to give that advice in the field of investments. They were all most gratified, therefore, that the *Financial Times* had been willing to associate itself with them in the joint venture of the *Financial Times*–Actuaries Index. In the modern age of computers, their only alternative would have been to fade out of the investment index picture as gracefully as they could. The Institute and Faculty were fulfilling a commendable role in regard to the *Financial Times*–Actuaries Index. The authors were to be congratulated on their efforts in support of that role by preparing the paper, in which they had described the basis of the index, discussed the various uses to which it could be put and indicated certain directions in which it might usefully be extended. On the other hand, it was equally the duty of the profession to make abundantly clear the areas in which the usefulness of the index was valid and those within which its usefulness might be doubtful.

In Part III of the paper—'The Index in Practice'—the authors had dealt fully with the areas of investment in which they considered the index to have practical merit: i.e. in checking portfolio performance, in the context of historical studies and economic surveys, for many day-to-day investment problems and, in particular, for directing the investor's attention to special situations which might repay investigation. For all those purposes, the index itself and the further information that could be derived from it were distinctly valuable. But in the area of investment policy where, in the authors' words, the purpose was to serve as a guide to investment policy, to assist in the timing of equity purchases and in the selecting of industrial groups, etc., he thought it was only right and proper that considerable reservation should be made, particularly as to the value of past records of market prices.

He repeated what he had said eight years before when contributing to the discussion on an earlier paper by the authors, namely, that the past records of market prices and other investment statistics, when viewed in relation to the political and economic circumstances which had existed from time to time, could have considerable value in building up investment background and experience and thereby making investors better equipped to formulate investment forecasts for the future.

When, however, they were faced with making an investment decision such as whether or not to purchase the shares of a company at the current price, and they were properly considering such relevant factors as earnings and dividends records and management policy, and trying to assess how the company might fare under possible future economic and political conditions; then, in those circumstances, the records of what the shares had been, rightly or wrongly, valued at in the past seemed to have little bearing on the matter and could, in fact, be misleading rather than helpful. Not only did that apply in arriving at an investment decision relating to an individual company, but it was also true whether the decision related to one particular share, a whole industry or to equities generally.

He sometimes wondered what it would be like if they all awoke one morning and found that, apart from the previous night's closing prices, all previous records of prices had been wiped out. It would, no doubt, be an investment analyst's nightmare, and it might also create difficulties for the financial journalist, but he ventured to suggest that some investment managers and other investors might as a result reach better and wiser decisions.

It might be worth while to examine briefly the nature of market prices the records of which were being so carefully preserved. The market price of a share at any particular point of time was the resultant of the investment decisions of a comparatively small number of investors. For every transaction, there was generally one party selling and one party buying. In effect, therefore, two contrary decisions were involved in any transaction. A preponderance of decisions to buy would tend to increase the price, and a preponderance of decisions to sell tended to bring it down. But whether or not the

price at any time reflected the proper value of the shares in the light of future prospects depended upon whether the preponderance of decisions were right or wrong, and many of those present knew only too well how easy it was to make wrong decisions. In the long run, the economic facts of life inevitably had to gain the upper hand and market prices would conform to those facts as they became known. In the short run, however, a preponderance of wrong investment decisions could carry the market price a long way from its proper level. Surely, when framing investment decisions for the future, it would be unwise to pay too much regard to the records of such prices over the past.

However much he might have attempted to cast doubt on the value of some of the investment statistics in framing investment policy and making investment decisions, there were nevertheless many other areas in which those statistics were of considerable value. Their uses in investment analysis were very wide and, if some of the further developments referred to by the authors in their paper could be achieved, an even wider scope for profitable investment analysis would be opened up.

The two main advantages to be gained from that were (*a*) a better knowledge and understanding of what had happened in the past, which should make investors better equipped to judge the future, and (*b*) the direction of investors' attentions to special situations in groups, industries or individual companies where fuller investigation might lead to interesting possibilities which might otherwise have been overlooked.

One of the most important features of the *Financial Times*-Actuaries Index was the fact that, being based on a chain principle, it was a dynamic index and thereby continually reflected the position of a currently representative portfolio. In consequence the future would never catch up with it and there need be no limit to its useful life; but however valuable it might be as a record of the past and as a statement of the present, people should not allow themselves to be carried away to the extent of using it as a crystal ball in which to see the future.

The President (Mr K. A. Usherwood) in proposing a vote of thanks to the authors said that the Institute was once more indebted to them for a valuable paper, which contained the ingredients which everybody liked to see in papers of that kind: a little history, quite a lot of fact, some proposals and certain discussion.

The discussion had been active and interesting, as indeed had been the discussion at the Faculty a week earlier. For his own part, the only comment he wished to make was to say that he endorsed a good deal of what Mr Hall had said about co-operation with others interested in the subject. Members of the Institute might be rivals with others, but there was no reason why they should not be friendly and helpful rivals.

Mr J. Plymen, in acknowledgment, said it was not surprising that the opener, on the whole, agreed closely with the viewpoint of Mr Haycocks and himself because he had, in fact, contributed a considerable amount of work to the investigations which led to the index. In suggesting, however, that a memorandum should appear in the *Journal* about the methods of construction and about the formulae for the adjustments, Mr Pain was taking rather a chance because he had had quite a lot to do with that part of it, and was the obvious candidate for the job!

The reason for the divergence in the preference and gilt-edged yields, of which Mr Fison had spoken, was merely the time lag. The fact was that the gilt-edged yields moved quickly and the preference yields moved about two or three months later. That was why the divergencies appeared when the yields were changing rapidly.

He was very interested in Mr Hall's comments about the discounted cash flow and the contribution of actuaries to the assessment of industry's financial plans. In that context, he might, perhaps, relate a story about how, as one of his investigations leading to the paper, he had visited America and attended a convention of American analysts. He was rather intrigued by a professor of investment analysis, who was on the platform, who spoke from time to time about yields, profit forecasts and growth yields, etc.

When the professor came to a difficult part, he would say 'That is an actuarial technique', and that absolved him from explaining any further. The other 120 people who were present seemed surprised to find an actuary at a convention of investment analysts. Certainly, actuaries did not do that kind of work in America.

Mr Day had spoken about groupings and homogeneity, which was a most important point, and he was quite right in his statement that ideally there should be a limited number of closely controlled groups. The trouble, as Mr Day had said, was that industrialists did not really play fair on that with all their diversification. Many groups were sanctified by usage; they had the blessing of history. There were all sorts of classifications in the statistical services that were based on groups. It was necessary to have a group for them even though they did not satisfy a pure test of all their constituents being exactly the same.

In reply to Mr Shillady, for whose comments he was grateful, he said that the position about the oil shares was very difficult. It was the basic problem of the purpose of the index. If the index was a kind of model portfolio, the oils should be included in it. If it was intended to show the progress of equities as a guide to the progress of the national economy, it did not need to include the oils because they were all overseas. The answer was that two indices were required.

The question of the dividends turning up had been referred to by Mr Clarke. Admittedly, on the chart in the paper, the turn-up of the dividends was rather microscopic. All that could be said was that in the original chart it looked rather more impressive. The evidence shown on that subject in the authors' earlier paper was rather more convincing.

Mr Clarke had spoken also about the tactical switches between capital and consumer goods. That technique was practised, it was thought, by institutional investors, some of whom had done it at the right time.

Mr H. W. Haycocks was very pleased that at least three speakers—Messrs Pain, Fison and Sandom—had indicated that they had ample material to enable them to produce papers on investment.

Mr Clarke had suggested that an investment manager might work best in complete ignorance except for information about the previous day's prices, whereas Mr Pegler was horrified at techniques which might take the profit out of the operation. For example, if everybody became convinced that high yielders were a better buy than low yielders, the difference between them would be eliminated automatically. The more the analyst looked into investment techniques and the more successful they were in improving them, the greater would be the stability in the market. That would be one of the main purposes of the analyst.

In that respect, they might notice a difference between, say, an investment manager's approach and a social investigator's approach. Admittedly, in the existing situation an investment manager probably wanted simply to use his own experience—probably good experience—and a few simple indices, whereas a social investigator wanted to find out what made investment managers 'tick', which was rather different. He also wanted to find out whether there was any order in the investment market and whether factors could be found which were closely associated with stock prices. Again, as Mr Pegler had pointed out, if there was any high degree of success of those techniques it might make the manager's choice of securities much easier because of the greater stability in the market as a result.

He agreed that correlation analysis was rather dangerous. As Mr Fison had pointed out, there was an arbitrary choice of variables. For example, there were many possible variables involved in the price relation. To some extent the choice was arbitrary and judgment was exercised after making an actual correlation analysis and testing the results. Another formula, which had been used with some success in America, was rather different from that mentioned in the paper. For example, one of the variables was a lagged price. Nothing like that had been published in Britain, and it would be

interesting if Mr Fison were to provide a note on the methods used by him to check his techniques.

Referring to the mention of the use of indices in connexion with economic surveys and wage rates, he admitted that on re-reading the paragraph in question and thinking about it again, he would have liked to have either withdrawn it or expanded it. If earnings were used as a wage index, the index would be nearer 500 than 380. An index of wage rates was an index of income and it would be wrong to make a simple comparison with an index of capital appreciation. Exactly what should be used to compare the investor's position with a wage index required to be thought out. Obviously, the measure should include income as well as capital performance.

Mr Sandom had mentioned the differences in published indices. Different indices meant different portfolios and, therefore, they could not be compared simply on their capital performance. It was necessary to look also at their income performance. They had only to consider for example, the difference that would arise between an index based entirely on, say, companies that were self-financing and one based on companies which had paid out all earnings in dividends and obtained capital by borrowing in the market. The price of the former would rise relatively to that of the latter because of self-financing, quite apart from the effects of other factors.

The authors subsequently wrote:

Mr Hemsted thinks that we are inconsistent in our descriptions of the portfolio which the index represents. If we consider a portfolio which takes up all rights, new issues, etc., with new money so that the distribution of the holdings according to market value remains proportionate to the distribution of the market capitalizations of the constituents of the *Financial Times*–Actuaries Index, then provided we measure performance by a chain index, each link occurring at a date of purchase, by definition the result must be the same as that of the index.

Mr Fison criticizes the weighted index as a criterion of portfolio performance. In his example, however, the weighted index appears to have correctly revealed the sub-standard performance of his portfolio due to the exclusion of the most successful constituent.

Mr Pegler and Mr Clarke also commented on the question of checking portfolio performance. The procedure, for applying index checks to portfolio performance, depends on the type of investor and the degree of activity. For a very large investor, too big to manoeuvre, investments will be bought for the very long term and the checks must be applied over an appropriately long period. On the other hand, for an active medium-sized institutional fund, the short-term results are surely the proper test as such an investor would attempt to keep his money invested in the more progressive groups and companies and his success would be checked by comparing the price and dividend performance with suitable indexes. Since the publication of this paper, the authors have received numerous inquiries from pension fund and investment trust managers wanting to apply suitable checks to their results and they are satisfied that the importance of using indexes for this purpose is becoming more and more recognized.

We agree wholeheartedly with the warning given by Mr Pegler. There is no simple method based on investment analysis that will lead to success in investment. However, we believe that it is sound for the younger generation of investment managers to be interested in applying the new techniques to the solution of their problems. A good manager can derive only help from these methods, he need not be led into a position of false security.

Mr Clarke mentions the reference to the wide price quotations of debenture stocks. It must be admitted that the reference to jobbers quoting 5 or 10 point prices was taken from some notes prepared some years ago and is no longer appropriate. With the reduced stamp duty, there is rather more activity in these stocks and jobbers' prices for the stocks used in the index usually show a spread of perhaps 1–1½ points at the most.

Mr Clarke spoke about the misleading nature of past price records. He suggests that if by some extraordinary accident all past price records were destroyed, this would be an investment analyst's nightmare but to the advantage of the investment managers. In these circumstances the analyst would be very little concerned because most of his work is based on past records of carnings which would still be available. Admittedly past price records and corresponding yields enter to a degree into the assessment of the relative ranking of a company against its group, but this assessment is in practice based more on consideration of past earnings records and future prospects than on past yield ratings.

Finally, the authors are very puzzled by Mr Clarke's sharp distinction between the investment manager and the investment analyst, as if these people formed two opposing groups working on different principles. They see no difference whatever between their principles and their objectives. Both are studying investment so as to discriminate between those with good prospects and those where the outlook is less attractive. The only difference is that the analyst may have the opportunity to specialize in particular classes of investment, obtaining a more detailed knowledge of these than the manager who has to cover a wider range of interests. In a large investment organization the manager's decisions are surely taken after considering the advice of his own analysts. One should of course, draw a distinction between the investment manager and the social scientist who is trying to understand the former's methods. Such findings would be useful to the investment analyst.

Mr D. Weaver wrote:

I was interested in the reference in this paper to the use of multiple correlation or regression methods as a tool in the evaluation of ordinary shares. We have for some time been thinking on these lines and have developed a relationship similar to the one suggested which provides estimates of the expected yield bases of a range of ordinary shares. The work has been done mainly by M. G. Hall and, although still very much in an experimental stage, others might be interested in a brief description of our results to date.

Initially our work has been based on an examination of around 100 major companies and the relationship derived expresses the dividend yield as a linear function of six independent variables, namely:

x_1 Rate of growth in ordinary share carnings over last five years
x_2 Proportion of carnings paid out in dividends
x_3 Setback variable
x_4 Estimated trend of earnings in current year
x_5 Estimated trend of earnings over next five years
x_6 Current share price in relation to the 'all time high'

It will be seen that, in line with the view expressed in the paper, we believe that the yield basis of a share reflects both the past record and future prospects of the company, in addition of course to the important effect of the proportion of earnings paid out in dividends. Of the six variables used, x_4 and x_5 represent our own estimates of the short- and long-term earnings trend of the particular share, whilst x_1 and x_3 refer to the past record. The setback variable (we judge the company to have had a setback if in any year earnings have fallen by 20% or alternatively by more than 10% in each of two consecutive years) was included because it was felt that investors are peculiarly sensitive to what may be a temporary setback and companies with records of uninterrupted growth records achieve very low yield bases. The share price variable was included because in many cases some regard is paid to the 'all time high' of a share, particularly in the extreme case where the dividend is passed and there is no yield basis on which to judge the share price.

The analysis has been programmed on a computer to calculate the yield relationship,

the expected yield for each share and the ratio of the actual yield to the expected yield. In addition, the analysis of variance table is produced from which it is possible to calculate the proportion of the total variation in the yield figures accounted for by the six independent variables in total and their individual contributions. Figures from recent analyses show that, on average, around 55% of the variation in the yields has been explained by the six factors, with the largest contributions coming from the proportion of earnings paid out in dividends and secondly the future profits trend estimates. The share price level x_6 appears to be both the least important and non-significant. The fact that it has not been possible to explain a higher proportion of variation suggests of course that other significant factors, such as the size of the company and any political risks, should be allowed for. On the other hand, we feel that, having obtained the yield ratios, the method can be used as a 'rough sieve' and the relative attractiveness of the shares judged making allowance for some of the more subjective factors.

The following table shows the value of the yield ratio (i.e. Actual Yield ÷ Expected Yield × 100) for six companies for six separate analyses:

Yield Ratio

Company	Jan. 1963	July 1963	Aug. 1963	Nov. 1963	Jan. 1964	Feb. 1964
Bristol Aeroplane	197·0	120·7	117·6	143·6	150·1	143·0
A.E.I.	91·8	114·5	114·3	97·2	97·9	105·5
B.M.C.	85·4	95·9	94·9	135·7	137·4	130·5
Alfred Herbert	87·5	85·5	91·4	83·1	84·9	101·0
Tesco	78·9	122·1	83·5	106·8	104·9	103·8
Marks & Spencer	70·9	74·0	70·1	71·5	72·5	74·8

The high yield ratio for Bristol Aeroplane reflects of course the market's uncertainty concerning the Government's attitude to the aircraft industry so that a somewhat above average figure may be expected. On the other hand, the change in the ratio of Alfred Herbert from a relatively dear to a relatively cheap basis, is consistent with the feeling that machine tool companies have now turned the corner. In conclusion, we would emphasize once again the experimental nature of this work, but the initial results lead us to believe that the evaluation of ordinary shares on a computer remains a feasible proposition.